The Varieties of Environmental Management

Identifying Sectoral Comparative Advantages in Addressing Environmental Valuation Failures

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Abstract

Markets and government are alternatively offered as separate solutions to address challenges resulting from improper valuation of environmental resources. Our current sustainability imperative requires an all-of-the-above approach that capitalizes on the comparative advantages of organizations and institutions from different sectors of society (civil society, business, nonprofit, academia, government). By looking at representative case studies from Australia, India, Morocco, and South Africa, this thesis examines how actors within these sectors have differing capacities in addressing environmental valuation. These case studies provide a preliminary survey to determine how to combine methods, techniques, and capabilities from distinct organizations to solve our environmental crisis. The structure of each organization gives them both specific advantages and limitations to create new ways to value the environment. Valuation problems examined include commons governance, externalities, and environmental resources.
Dedication

For Us.
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Remember upon the conduct of each depends the fate of all.

– Alexander the Great

In 2011, I walked, flew, cruised, sailed, swam, scuba dove, climbed, hiked, drove, trained, paraglided, and hitchhiked around the world twice. I kept my eyes and ears open. What I experienced has made me hopeful. I am hopeful for the Indian teacher and the five thousand saplings he gives away every year. I am hopeful for the activist found in a Ghanaian library who works on natural resource management. I am hopeful for the students who created and run a 350.org chapter in Vietnam. Individuals are recognizing their environmental responsibility.

Across the world, the effects of climate change are becoming apparent. Scientists are not the only ones catching on; old men are noticing. Abraham, a village elder in Morocco, and the senior who saw me for English practice in Malaysia, or, Mr. Han, the retired construction worker in Shanghai. Elders know the climate is different now than it was throughout their youth.

Climate change is not the only problem. Increasing human population and influence is putting pressure on the earth’s systems. The list of our environmental challenges is long: the freshwater crisis, endangered biodiversity, and collapsing fisheries. The way we approach the environment causes many of these environmental challenges. Some result because we do not properly value the services the environment provides or account for the negative environmental impacts of our actions.
No longer can we ignore environmental challenges. Addressing them soon and effectively will directly affect the collective quality of life for our entire species. Environmental instability, on the other hand, will breed conflict, inequality, suffering, and, ultimately, regret.

The next fifty years will determine the fate of our environment and species. The amount of change necessary to psychological, social, economic, political, and cultural fronts is immense—the consequences for failure even more so. Our species’ moment has arrived. What do we choose?

For a long time we have tried to create a definition of what it means to be human. We argue that the human is the only species that uses tools, has language and writing, and passes on intergenerational knowledge. Looking at chimpanzees, dolphins, and elephants, those definitions lose value. We try to separate ourselves into a distinct category of life, yet we still behave within the same ecological principles as any other species.

I, for one, choose to go beyond our limitations as a natural species. By recognizing our environmental challenges and changing our behavior, we have the potential to become a distinct species—the first species to recognize and react to our own ecological limits, preventing a population correction. We have the potential to become human stewards of the earth.

To do so, we must develop methods to curb our environmental impact and manage the environment itself. The capabilities of the organizations that lead our environmental actions will determine whether we become that distinct species.

This thesis analyzes five types of identified actors in environmental management activities. In order to take advantage of the varieties of environmental management, we
must recognize the strengths and capabilities of each actor. Only by knowing the structures to manage the environment can we best use them to react to the challenges we face.

The solution to the environmental challenge requires an interdisciplinary cross-sectoral approach that simultaneously works to change our technology, our activities, and our way of viewing the world. No one actor can provide the solution. Free market environmentalism or government regulation alone will not work. The variety of challenges that we face due to our failure to properly value the environment requires a variety of solutions. Civil society, business, nonprofits, academia, and government all have their respective roles they must play in creating a new environmental paradigm.
**Introduction**

*The Varieties of Environmental Management*

In Stellenbosch, South Africa, Michael Back, owner of Backsberg Winery, decided to do something about his winery’s environmental impact. Michael became an environmental champion, encouraging the adoption of sustainable methods and practices at Backsberg. These environmental initiatives are having a profound impact on the winery’s operations, and Backsberg is now discovering new sources of value. Instead of using large amounts of energy to cool his red wine fermentation plants, Backsberg has installed a system that uses minimal amounts of electricity to circulate cold water from the bottom of a pond. Changing crop methods has reduced vehicle fuel consumption while also allowing for increased yields. Today, Backsberg has an ISO 14001 certified environmental management system. A standardized system, ISO 14001 helps organizations develop procedures to identify and reduce environmental impacts on normal operations. More impressively, Backsberg is one of three carbon neutral wineries in the world and has won multiple accolades for its environmental practices. In September of 2011, I visited Backsberg. During that year, I spent eight months travelling around the world investigating organizations like Backsberg to learn more about how different people, organizations, and institutions are acting to preserve our environment.

By implementing sustainability at its operation, Backsberg is addressing the major challenge of this strategy: assigning a value to the environment. As an organization, Backsberg’s environmental initiatives are reducing the negative externalities associated with wine production. Externality is an economic concept; it basically means a cost that is incurred due to an economic activity that is not reflected in the price of the product. For
instance, pollution is a negative externality because it causes environmental damage that society feels, but the cost of this outcome is not reflected in the production cost. This type of externality is a market failure, or an instance in which markets are not able to efficiently allocate goods or services (citation?). Many environmental problems are the result of market failures.

Market failures are an identifiable symptom of a much larger problem. Our current global, economic, social, and political system does not value the environment properly. Climate change is a vivid example. Currently, our economic activities release large amounts of greenhouse gases into the atmosphere. In most countries these emissions are not priced, but they do have a cost. Greenhouse gases are accumulating in the atmosphere and beginning to have many negative effects, such as droughts and extreme weather. Fossil fuels are cheap because they come with a hidden catch: damage to our climate control systems. Overall, the environment is not properly valued, which is the reason behind the push towards environmental sustainability. In a sense, long-term sustainability is about changing the way in which we value the environment; properly valuing the environment will lead to the adoption of behaviors and practices that preserve the many benefits nature brings to society.

Across the globe, different parts of society are reacting to the needs and demands of environmental sustainability. The five sectors of human society all have different focuses and various abilities. Though some find it a priority to act harmoniously with nature, others do not. The characteristics and involvement of these sectors determine the effectiveness of the human response to the present environmental crisis. Globally, comparative institutional and structural advantages of actors within a specific
sector of society (civil society, business, nonprofit, academia, and government) determine their capability to conceptualize and implement environmental innovations, initiatives, and paradigms to address environmental valuation challenges.

The different sectors of society are made up of different institutions and organizations. Institutions play an important role in governing and managing human impacts on the environment. Institutions are social constructs that “provide a set of habits, rules, and norms” which, in this case, regulate “interactions between human societies and their natural environment” (Matutinovic, 1112). In this analysis, the only institution I examine is the Berber Agdal Institution of the High Atlas Mountains. The rest of the case study focuses on organizations that are representative of the “average” actor within each sector.

There are many different ways to break society into smaller sectors. For this analysis, I have broken human society into 5 sectors based on structure and functional behaviors. According to Dollery and Wallis, “numerous scholars have attempted to … differentiate between the private, public, and voluntary sectors” (2). Roughly, these sectors break down as follows: the private sector composes the market economy and is composed of businesses, the public sector is the government, and the voluntary sector is made up of nonprofit organizations and individuals within society. The voluntary sector has been particularly difficult to classify. Worth notes that this sector has been alternatively called the “independent sector,” the “third sector,” or the “charitable sector” (9). For this analysis, I break up this sector into two distinct parts: civil society and nonprofits. These two facets of the voluntary sector are different because nonprofits are
mission-driven organizations, whereas civil society is composed of individuals and institutions that are not organizationally bound. In addition to this sectoral breakdown, I have added a fifth sector based on functional attributes. Although the academia sector is distinct from other sectors due to its functional independence and research oriented focus, it is often supported by actors from other sectors. These classifications present challenges in and of themselves. Due to the brief nature of this thesis and the case study structure, this sectoral breakdown is sufficient.

Civil Society

Civil society operates and impacts the environment through aggregate collection of individuals’ actions. The civil society sector consists of mostly individual and some business behavior. Businesses included in this context are all service businesses or family operations that have minimal environmental impact through their operations. The individuals in this sector impact the environment through the deployment of different innovations, through consumption behavior, and through personal action. Major challenges include the current culture of consumption, disconnect with environmental impact, and population growth. Impacts from this business-as-usual state are unintentional degraders of the natural environment, requiring environmental management from the other sectors.

Business

Medium and large for-profit enterprises employing at least several non-family workers comprise the business sector. These businesses range in size, geographic location, and market function. Some have more ability to reduce environmental impacts, such as a farm substituting pesticide. Others cause social or environmental instability
through their activities. For instance, mobile phone companies and their consumption of coltan have driven the civil war in the Democratic Republic of the Congo. Furthermore, there are oil companies that facilitate the consumption of carbon polluting fossil fuels as they ‘meet’ our demand for oil. Environmental management within businesses has several stages of complexity, from product substitution and energy efficiency, to reinvestment of savings, to realization of sustainability value.

### Non-Profit

The non-profit sector is made up of environmental organizations that have a conservation, education, advocacy, or social issue for which they advocate. These organizations have a social mission or purpose, which allows them to focus on specific issues. The mission-driven structure and private management defines the nonprofit structure. These organizations can vary in size, from large multinational non-governmental organizations (NGOs), such as World Wildlife Fund (WWF) or Conservation International (CI), to small operations, such as local land trusts. They are able to address global environmental challenges without regard to funding. The challenges are lack of regulatory or statutory power, lack of participation, and lack of funding.

### Academia

The academia sector consists of public, private, and educational research facilities and organizations. These institutions fund research, retain experts, and expand the human body of knowledge. This research takes on a variety of perspectives and occurs in a number of disciplines, including technological innovations, environmental technologies, and the social sciences. The nature of research makes international collaboration easy.
Indeed, all of the research facilities that I visited and researchers I interviewed had research collaborations with locations in the United States. These institutions not only develop new technologies but also new ways of approaching the environment. They are increasingly challenging and changing the notion that the economy is more important than the environment, which is providing us with a new way to understand our relationship with our environmental support systems.

**Government**

The government sector consists of multiple layers of government, structured differently according to government type. The most common government layers are local, state or provincial, national, and international. The government often has statutory authority, regulatory power, and the ability to make laws governing conduct. It is often legally obligated to protect or govern the environment, but is often criticized as bureaucratic or ineffective. Government agencies commonly have specific missions or agendas, but these can be jeopardized by political considerations. Nevertheless, the government has substantial power in addressing environmental valuation challenges.

Each sector is better at something than other sectors. When addressing environmental valuation challenges, the inherent nature of organizations makes their capabilities different. A government has the power to legislate while a nonprofit can only advocate, but can do so freely. When working on different projects or initiatives, individuals can have the largest chance of success by recognizing which incentives drive actors. An example would be for an individual to know that the best way to start an environmental program at a business is to quantify it through savings. Quantifying and
translating environmental programs into business models is a strong skill and tactic not just for businesses, but also for government and nonprofit organizations.

Methodology
This thesis is based on research I conducted during my travels between May 5, 2011 and December 13, 2011 in Australia, Morocco, Ghana, South Africa, India, Malaysia, Vietnam, China, and Japan, using interviews, lectures, observations, and materials from different organizations and individuals.

The thesis employs tenants of grounded theory, which, as described by Kathy Charmaz in Constructing Grounded Theory, consists of “systematic, yet flexible guidelines for collecting and analyzing qualitative data” that allow for the creation of theories and ideas based on the data itself (2). Grounded theory is diagnostic and not prescriptive in that it looks at phenomena or processes. This allows for a conceptual understanding of what is being researched. One of the main tools of Charmaz’s grounded theory method that I used was coding. Coding, undertaken during the research process, attempts to categorize data to allow for refining of research methods. Coding works by “categorizing segments of (qualitative) data with a short name that simultaneously summarizes and accounts for each piece of data” (Charmaz, 43). By analyzing data during the research process, I was able to improve my interview questioning and identify new research priorities and questions. This allowed me to recognize the importance of collaboration for different types of organizations. An example of a trend that I identified using coding is partnerships. During the initial interviews, I noticed that organizations engaged with a number of partners for their projects. After looking at these relationships I created a code that summarized this method: partnerships. To build upon this initial
discovery, I added questions regarding organizational partners and the extent of collaboration. When I was assessing the academia institutions in India, this focus allowed me to uncover a major organizational strength of academia: international partnerships. The research institutions I visited in India all relied on partnerships with organizations in other countries to increase their capacity to do research. By comparing the partnerships of these research institutions with the traits of partnerships in other sectors, I was able to notice a difference. Unlike other organizations, this collaboration was central for the research institutions to achieve their objectives. After completing my field research and the grounded theory process, I analyzed selected case studies from each sector. This analysis was complemented by a literature review.

**Thesis Outline**

In the next several chapters I will report on a variety of innovations, methods, and ideas from a number of sectors all around the world. With the exception of the first case study, these organizations are all successful examples of environmental initiatives and management. Though a more in-depth study would allow for an exploration of the negative examples of organizations, this analysis focuses on the organizations’ capacity to change behaviors and recognize the value the environment brings to society. These positive examples demonstrate how different actors across all sectors of society are beginning to create the new environmental paradigm.

First, you will hear a modern day tragedy of the commons in the Atlas Mountains of Morocco. A self-supporting society developed innovations in the form of a complex irrigation system that maximized water retention and increased agricultural productivity in an arid environment. Unfortunately, internal pressures from population growth have
eroded the hillsides that support irrigation water. Moreover, increasing pastoral activity has destroyed native vegetation on mountainsides. The resulting erosion has been incredible. Some hillsides have washed away entirely, decreasing soil quality and water retention capability. The hills’ ability to retain water has been compromised and government intervention has been needed in the form of an intentional environmental management program. This case study will illustrate how civil society can adapt when it recognizes the value of environmental resources, but can fail when it does not.

Next, in the second chapter, you will hear the story of a champion. South Africa’s Backsberg Estate Cellars started its environmental program thanks to the drive and persistence of its organizational environmental champion and owner, Michael Back. His ambition and initiative led to the adoption of the internationally recognized ISO 14001 Environmental Management System at Backsberg. This organization instituted programs that took advantage of technological innovations, such as a hydrothermal heat pump to chill fermenting grapes. It also engaged proactively as a responsible environmental steward, setting aside ten percent of its land to conserve an endangered biome. Backsberg illustrates the positive role that businesses can play in addressing the environmental imperative.

In the third chapter you will join me for an afternoon tea with a woman named Jax who is the head of a conservation organization in Kuranda, Australia—an area with a population of three thousand. As she force-feeds me toast and vegemite, Jax tells me about her nonprofit environmental organization, Kuranda Conservation, and its work on a number of environmental initiatives, one of which is the preservation of endangered cassowaries. She runs a community nursery for plants and helps organize the local
response to invasive feral pigs. As a mission-driven organization, Kuranda Conservation is able to focus on protecting biodiversity, an invaluable resource.

In the fourth chapter we will meet with some of the academics that are researching new social innovations and technologies that may change our perspective of the environment. The Madras Institute for Development Studies (MIDS) is an independent think in India that focuses on regional development issues. MIDS conducts economic, scientific, and social research that shows the value of managing resource sustainably. The Center for Wind Energy Technology (CWET) researches technological innovations to help India’s domestic wind industry; however, most of their research uncovers innovations that have already been discovered and patented by western corporations. CWET has the only wind testing facility in Asia. These research institutions provide us with the tools necessary to change our understanding of the environment’s role and also make technological discoveries that enable us to protect it.

In the fifth chapter you will learn about a government agency. Not far from Backsberg, the City of Cape Town’s Environmental Resources Management (ERM) Department has successfully enacted a number of environmental programs and initiatives despite local government not having a mandate for environmental management. It has used organizational environmental champions to demonstrate what the benefits of environmental perspective are to the other departments in the city’s government. Furthermore, it has quantified the value of local ecosystem services to enable informed decision making in development policies.

**Environmental Valuation Challenges**
One of the main causes of our current environmental challenges stems from the inability to properly value the environment. The environment provides many different services that are not accounted for in the market economy but come from the natural economy. The natural economy “processes everything, adapts to everything, absorbs wastes and other externalities from the marketplace, and passes the effects” of externalities back into human society (Plater et al., 729). Many of these valuation challenges are types of market failures—an economic concept. This thesis will address common governance challenges, externalities, and valuations of different types of environmental resources.

**The New Environmental Paradigm**

There is a significant debate regarding whether the private or public sector is best suited to solve our environmental challenges. On one hand, the current approach to our environmental challenges has focused on “technological progress” and “market mechanisms” (Matutinovic, #). The idea that markets will solve our problems stems from free market environmentalism. This position “emphasizes markets as a solution to environmental problems,” and “proponents argue that free markets can be more successful than government” in solving environmental challenges (Stroup, #). Free market environmentalism holds that property rights and market mechanisms will solve environmental challenges. This view is antagonistic to government intervention; Stroup argues that the government’s “ability and incentive to engage in farsighted behavior is lacking,” making environmental stewardship from government activities difficult. The government is seen as less efficient than the market and as lacking incentives for
environmental preservation. This view is often criticized as justification for the status quo of market domination, which has led to our current environmental crisis. The opposite view contends that “government involvement in environmental issues is both necessary and inevitable” due to multiple reasons (Andrews, 715). Governments are needed even within a free market system to enforce property rights and the rules of markets. Furthermore, governments “provide collective goods that markets do not” as “markets undervalue or even fail to value such goods” (717). This side argues that privatization is not the ultimate solution because some assets are difficult to protect. Their users “may be too numerous, too diverse, or too separated in space or time” (717). These two competing views, free market environmentalism and government involvement, have dominated much of the debate regarding which sector is best for solving our environmental challenges.

The solution to our environmental challenges involves the creation of a new paradigm for understanding the human’s relationship with the environment. Markets in the form of businesses and government both have different capabilities to address environmental challenges. The complexity, scope, and scale of the environmental imperative means that free market environmentalism and government involvement are incomplete solutions. In order to solve our environmental challenges, individuals, organizations, and institutions from all sectors of society must use their specific advantages to change the way we value the environment. Business action or government intervention alone are insufficient. Collective action and intersectoral collaboration are necessary. The new environmental paradigm recognizes that social, economic, and environmental health are inextricably linked. The current path that prioritizes economic
growth over sustainability will lead to disaster. Only through collective efforts that take advantage of sectoral comparative advantages will we be able to effectively address the many environmental valuation challenges that impede global sustainability efforts.

Chapter 1
Tragedy of the Berbers Commons

Water is our life. When the water flows, we are happy. No water, no good.

– Abraham, village elder of Ait Zitoune, High Atlas Mountains, Morocco

Ait Zitoune is a small village located fifty miles south of Marrakech along the foothills of the High Atlas Mountains. It lies at the top of a valley, near the apex of a leg extending down from the mountains. A seasonal river and the occasional flood carved the bottom of the valley out. The valley itself is a sea of green in a plain of brown due to irrigation and strategic crop planting. Ait Zitoune consists of a group of houses along a main, minimal dirt road. There are about ten families, all of which are farmers, and no local stores or mosques. The village is built around the community irrigation channel, which carries water from the mountains. The area is an arid, desert environment, making water an extremely important resource for agriculture. The people of this area are called Berbers, and they have lived in the
mountains throughout the last two thousand years. The Berbers are an agricultural and pastoral group. In Ait Zitoune the value of water is so high that the roofs are designed to drain into the community irrigation canal. The people produce all of their own food and currently do not require any external support to survive.

Regardless of these initiatives, the village and Berber society are challenged by a problem of their own making: erosion. Morocco’s demographics are changing as populations grow, and there is large rural to urban out-migration. Population growth jeopardizes long-term sustainability and causes local environmental degradation. Overgrazing of hills and mountainsides by goats has stripped the grasses that have held the soil back, resulting in severe erosion. These lands play a vital role in watershed management, and their degradation threatens a water-dependent society. The degraded land lacks ownership and is considered common land—all can use it. Despite having an institution that is designed to manage these common lands, known as the Agdal institution, Berber civil society is not effectively responding to the erosion challenges, requiring the intervention of the national government. Human activity was unintentionally having negative environmental impacts. The national government became involved, encouraging erosion control practices and replanting trees to restore local watersheds. The challenges faced by the people of Ait Zitoune are a modern day tragedy of the commons. Overpopulation has led to overexploitation of common resources in a fragile environment. The case of Ait Zitoune demonstrates how civil society is unable to respond to certain disruptors, such as population change, because of its structure. This failure has created the need for environment management to address
environmental valuation failures, which the national government of Morocco is currently pursuing.

In early September of 2011 I visited Morocco with a trip organized by my study-abroad program, Semester at Sea. We spent several days hiking around Berber territory and visiting the small villages of Ait Zitoune and Ait Hmad. We walked up dry riverbeds, along mountainsides, and on top of valleys. Our guides were Mohamed and L’Haucine. Mohamed was from the Middle Atlas and graduated from law school. L’Haucine was from the High Atlas and had a degree in physics. Despite these degrees, Mohamed and L’Haucine worked as tour guides because of the high earning potential. As we walked Berber lands, they told us about local practices and customs. We spent the first night in Ait Zitoune and met with Abraham, the village elder. Mohamed and L’Haucine translated as we asked the elder about Berber life and the local environment.

Ait Zitoune lies on the edge of the Haouz plain at the foot of the Atlas Mountains. Although it is close to Marrakech, Ait Zitoune remains geographically isolated. The national government provides education and has recently supplied electricity to some areas at subsidized rates. A single dirt road goes through the village along the top of the valley. People mainly traverse this road by foot, mule, the occasional motorcycle, and the rare car. The area is dry and brown; it only rains about 250 millimeters per year, most of which falls during the “wet”
seasons: winter and spring (Raki, 2). There is higher precipitation in the mountains, where the average annual rainfall is anywhere from 300 to 1000 millimeters per year (Funnell and Parish, 92). Ait Zitoune’s irrigated water all comes from this mountain rainfall, either down the river or through the irrigation canal.

**Agriculture and Local Self Sufficiency**

Local farmers plant a large variety of crops that are both indigenous and introduced. Indigenous crops include olive trees, figs, and cacti (see Figure 3). These indigenous crops are often grown on the edge of fields to mark boundary lines. Though cacti are planted anywhere, olive trees surround the fields in the river’s flood plain. Notably, these indigenous crops are all perennials, meaning that they grow and produce seeds over several years (citation?). These crops are also low maintenance, requiring less farm labor. Most introduced crops are annuals, meaning that they grow, develop into fruit, and die all in one season. The Berbers use introduced crops from new world and old world crop packages: maize, barley, pumpkin, squash, wheat, tomato, bamboo, potatoes, and mint (see Figure 4). These crops have much higher water needs than the indigenous crops. Most fields are dedicated to either growing indigenous crops or staple grasses, such as maize or barley. These fields are small, expanding no larger than a few acres. These main crops are the largest local source of food and fodder. Excess from the main crops can be sold to generate income to buy goods and services from nearby cities, such as headlamps and electricity. Farmers also have personal vegetable patches. “Every family has a plot or piece of land next to the house where they grow some vegetables, mainly potatoes and tomatoes,” our guide Mohamed tells me. “Every single family has a place where they grow mint for their own tea.” In the Atlas, mint tea is called Berber
whiskey, which is ironic in this dry country. Berbers drink it with most meals and at various points throughout the day. The various crops grown by the Berbers have different water needs, making the management of water supply important to maximize yield.
Figure 3. Indigenous Crops Identified Around Ait Zitoune
Figure 4. Introduced Crops Identified Around Ait Zitoune
To produce as much as possible, the civil society of the Berbers has organically adopted two types of irrigation systems: flood and built. Flood irrigation allows farmers to grow crops in the valleys and next to rivers. These systems are dug systems that consist of canals and retention ponds. These canals direct water from the river into their fields. Retention ponds consist of areas dug out and surrounded by water to retain water for the fields. These ponds were designed to capture and retain flooded water, which enables the feeding of crops after flooding recedes. While most crops served by flood irrigation are introduced species, retention ponds are used for olive trees. These trees are particularly healthy, and Muhammad told us they produce much more than other trees due to the extra water. These trees also live much longer, having an intergenerational benefit. Overall, flood irrigation allows the Berbers to grow large amounts of crops in river valleys.

Built irrigation consists of human-made channels and water systems that supply water to fields on top of the hills. When possible, the channels are built at the apex of the hill to enable gravitational flow of water. These systems travel through several villages, with their source ultimately originating in the mountains. They consist of simple concrete channels with metal floodgates and periodic concrete cisterns. Dug canals direct water flow from the floodgates and across the fields. Often fields are designed so that any excess water flow is channeled either back into the irrigation channel or into other fields. I was shocked one time to see water flowing from the end of a field into the road, for it did not seem to fit in with the rest of the system. Then I realized the water was directly flowing across the road and into a small maize field. The storage capacity of the cistern makes water available even during the dry season. Roofs are designed to drain water into
the canal when possible. Overall, the built system is conceptually complex but technologically simple. Concrete and made by hand, this system recycles water, minimizes water waste, and allows locals to grow crops in the dry season.

Berber society in the High Atlas Mountains is self-supporting. Electricity and education are delivered by the government and desired by local people. Otherwise, the Berber lifestyle, and especially their political economy, is independent. “Everyone has a job to do,” says our guide L’Haucine. Men, women, and children all play different roles. Children often tend herds. While some animal plows are used to till large fields, most farm work is done by hand. Gravity supplies water from the mountains, whether down the river or through the built irrigation system. There are no electrical pumps for the irrigation system and no piped wells. Fields are fertilized using animal dung, and there is no use of off-farm inputs, such as artificial fertilizer or pesticide. Farmers use the seeds from their crops to plant the next harvest. Abraham, the village elder, tells us with pride that “families have a crop storage that can feed them for at least six months and up to two years.” Abraham knows the outside world matters little to the continued existence of its people. Even though the people have challenges getting proper education, healthcare, and basic services, they produce all that they need to survive. The Berbers of Morocco are, therefore, dependent on their land and water to prosper.

In the region around Ait Zitoune, crops are strategically planted according to their water needs. “The family land is split into two areas: the irrigated and non-irrigated zone,” according to Mohamed. The indigenous plants have adapted to the arid environment and only need natural levels of precipitation. These indigenous crops
Irrigation Methods around Ait Zitoune

The following pictures illustrate some of the technologies and irrigation methods around Ait Zitoune. Clockwise from top left: 1. Retention pond used to store extra water from flood irrigation. These trees have high levels of production and live very long lives. 2. Built canal irrigation. 3. Cistern down the canal from Ait Zitoune. 4. Built canal and dug canal interchange in around cornfields in Ait Zitoune. Dug canals direct water flow during irrigation. Note the divider between the built and dug irrigation systems is a simple metal gate.
are planted in both the irrigated and non-irrigated zones, but most often in the non-irrigated zone. For example, olive trees are most often seen on the side of hills, where neither flood nor built irrigation can reach them. Olive trees are also in the flood plains where they are watered along with maize, barley, and vegetables. Several stands of olive trees have retention ponds that catch high floodwaters and can channel water from the river. These trees produce more than their counterparts in non-irrigated areas and also require minimal maintenance throughout the year.

Water-intensive introduced plants were mainly planted in irrigated areas. Fields of introduced plants surround the canals at the apex of hills, occupy the best flood plains next to rivers, and are crisscrossed by flow canals. The Berbers recognize as an agricultural practice that their higher water demands from these plants necessitates a dominant portion of irrigated land and precious water. The fields on top of the hill crests are designed so that excess water flow may either flow into fields or terraces lower on the hill using gravity, or into channels that direct water back into the irrigation canal. The fields or terraces farther from built irrigation consist of crops that have lower water needs, especially indigenous crops. The edges of many fields consist of the indigenous tree crops, olives, and figs. By edging the field with these trees, excess water from irrigation is not wasted and is instead used by another crop. This strategic planting of crops in accordance with their water needs demonstrates the Berber recognition of the high value of water in this mountainous desert environment and their need to maximize the use of available water.

Berbers raise livestock and have pack animals. The most common livestock are goats, although there are some chickens and a very few cattle. These different grazers are
let out and grazed during the day. Men and children are often responsible for watching over the herd. Livestock are grazed in many different pastures: in valleys, on top of hills, and on mountainsides. Berber society makes use of common areas for grazing. This means that many fields are open to any farmer to graze his or her livestock; however, this makes him or her subject to any common governance structures that might be in place. A prominent Berber method of governing common lands lies in the institution of Agdal. The manifestation of Agdal “varies between Berber groups and regions” but generally sets up different rules for common lands (Ilahiane, 24). Most important, Agdal sets up the opening and closing dates for the grazing of specific common pastures. It acts as a conservation method created by civil society. The system “always involves a temporary respite from use” by grazers with the goal of “conserving or deferring the use of resources for critical periods” (Patrimony). One village can exclusively use the pastures, or they can apply to semi-nomadic “clans and tribes” (Ilahiane, 24). However, the Agdal has serious limitations. It does not govern all common lands; these lands are often “reduced to erosion and scattered patches of vegetation” (Ilahiane, 40). Furthermore, the governance institutions themselves are under stress due to conflict over use rights.

**Population**

Population growth has put significant pressure on natural resources for agriculture and livestock grazing. There have been two main responses to population pressures: out-migration to cities and overuse of land. Out-migration is a “major adjustment mechanism” to population growth (Funnell and Parish, 95). People are leaving rural areas to head to urban areas or foreign countries because of limited opportunities. Land
degradation is attributed by many scholars to “overuse of the natural resources by human and animals populations:” this overuse is linked to “a rising population” and changes in livelihood (Funnell and Parish, 93).

Higher population has caused erosion that threatens water supply for Ait Zitoune and degrades pastureland. Increased goat grazing on the sides of the mountains that feed Ait Zitoune’s irrigation system and river has stripped away local vegetation. Land degradation threatens watershed retention – an ecosystem service provided by nature. An ecosystem service is a condition or process “through which natural ecosystems…. sustain and fulfill human life” (Daily, 3). These services range in scale and scope. In the case of the Berbers, ecosystem services provide hydrological system management. Population growth causes an increase in “grazing intensity” which leads to “profound changes in the functioning” of ecosystem support services (Daily, 246). Heavy grazing leads to erosion by reducing “plant biomass and cover” and by increasing “bare ground” (Daily, 247). As goats over grazed hillsides they reduced the hill’s retention capabilities. Soil is more likely to wash away when it rains. Additionally, animals are “trampling and compacting the soil surface” which increases runoff and soil erosion (Daily, 247). Erosion causes many challenges.

Erosion in the High Atlas does not just affect the Berbers. Siltation caused by the erosion is “rapidly decreasing” the storage capacity of Morocco’s dams down in the lowlands (World Bank, 31). As the soil from the mountains washes downriver it is deposited in manmade reservoirs that supply Morocco’s cities and agricultural lands. Much of this siltation damage is attributed to the “poor population … in the mountainous catchment areas” whose economic activities create “favorable conditions for erosion”
(World Bank, 32). A local environmental problem is now threatening the countries water infrastructure.

**Tragedy of the Commons**

The erosion challenges faced by Ait Zitoune and local Berber villages are a modern day example of the Tragedy of the Commons. The tragedy of the commons was an idea put forth by Garrett Hardin in an influential article in 1968 in *Science*. Hardin argues that population growth causes degradation of common resources due to every individual’s desire to maximize his or her personal well being. Hardin’s example is a common pastureland. Every individual who uses that land has the incentive to graze their animals as much as possible because the land is a community resource. “Each herdsman seeks to maximize his gain” from the field, and no individual has personal responsibility, or incentive, to preserve the commons. As every individual will try to exploit the commons as much as he can the commons will become quickly overused. Hardin designed the commons dilemma as a premise to his argument about the dangers of population growth. Today, population is recognized as only one of several causes of commons challenges. A recent example of a tragedy of the commons is greenhouse gas pollution. Every human has access to our atmospheric commons and lacks the incentive to minimize their exploitation of the commons. The driving factor beyond greenhouse emissions currently is changes in affluence and modernization. There are many other examples. Elinor Ostrom, Nobel Prize winning economist and expert on the commons, points out many different ways that the commons has been applied: “the Sahelian famine
of the 1970s, firewood crises throughout the Third World, the problem of acid rain” (Governing, 3).

In the High Atlas, the Berber challenges with environmental degradation and population illustrate a number of key concepts of the tragedy of the commons. While Hardin used the tragedy as a metaphor to discuss global population, the tragedy applies to sectoral analysis of environmental management. Actors have structural incentives based upon environmental governance regimes. What this means is that actor’s behavior is influenced by what they are able and rationally desire to do. The herdsman of both Hardin’s imaginary pasture and High Atlas mountainsides are incentivized to use as much of the pasture as possible. The driving force behind the environmental degradation around Ait Zitoune was population, as in Hardin’s example. However, population is not the only cause of commons problems. Population is a type of internal disruptor. An internal disruptor is a negative change in a civil society’s behavior, population, or consumption. These disruptors cause social and economic changes which can lead to increased environmental impact. For the Berbers, increased population drove individuals to marginal, ecologically vulnerable lands. The thin soil in the Atlas Mountains made hillsides particularly vulnerable to erosion. Population acted as a disruptor that jeopardized the stability of commons land.

**Effects of Tragedy of the Commons**

As Berber society in the Atlas Mountains developed, their wellbeing increased, ultimately resulting in increasing population. One of the major impacts of the commons problem is the socioeconomic tragedy of the commons. This occurs when different levels
of personal or familial wealth within a society determine one’s ability to adapt. Individuals or organizations with more wealth, resources, capital, or land are more likely to be able to weather and adapt to environmental challenges or population pressures. In Ait Zitoune, one manifestation of this was in large numbers of young adults heading to the cities. Increasing population meant that more land was needed to support new agricultural livelihoods and families. As most high quality land was already occupied, rising children were either forced onto marginal lands or into the cities. For the Berbers, it meant more goats grazing. Thus the people causing erosion were those who had little other choice due to lack of available land. When environmental degradation and erosion intensified, the farmers most dependent on using the commons were most impacted. Those on the highly productive land, often the wealthiest, were least impacted. This presents major challenges as the poor, who are least able to change their activities, are causing the environmental challenges. In this case, population caused environmental degradation, leading to major social and economic changes that drive rural to urban migration. An environmental problem had negative social impacts.

The tragedy of the commons is a challenge for civil society. A conclusion from the tragedy of the commons is that the solution to commons challenges is through “an external actor”: privatization or government control of resources (Ostrom, 13). By privatizing common land the new owners now have the incentive to conserve the land. Government control would also put incentives for preservation in place. This would entail that civil society, after degrading the commons, would lose communal control over the commons, with individuals and government taking over. The failure to properly manage the commons does not preclude civil society from developing new methods to
govern the commons. Ostrom argues that while external intervention is sometimes necessary the “capacity of individuals to extricate themselves” from commons challenges “varies from situation to situation,” providing various examples of successful governance of the commons by civil society (14). The civil society of the Berbers could use the Agdal institution to try to manage their commons problem on their own. However, the situational circumstances make the effective commons governance unlikely. Current degradation requires repair, which either needs an external agent to take control or Berbers to develop new civil society institutions to manage reforestation. More importantly, in Ostrom’s examples, population was static (88). Civil society’s ability to cope with internal disruptors without external support is limited. In Ait Zitoune, the internal disruptor threatened not only grazing land, but also the availability of precious water resources.

Population growth presents major challenges to traditional management changes. There are challenges due to increased resource consumption, more demands, and transmission failures. Transmission failures can occur when a “rapid change of population” leads to circumstances where “the general principles… of effective community-governed institutions” are not handed down (Ostrom, Understanding, 273). The societal disruption from population growth means that traditional institutions may lose adoption rates. The Agdal, even if successful in stopping degradation of common lands, will likely not be adopted by all new members of the current generation.
Environmental Management and the Commons

The tragedy of the commons experienced in the Atlas Mountains was caused by unintentional environmental management activities. Unintentional Environmental Management (UEM) refers to any large-scale human actions that alter or adapt to the environment without the specific incentive to reduce environmental impacts. Large-scale activities that alter the environment include such things as agriculture, which change local lands significantly and affect local ecology, and automobile use, which aggregately releases enough carbon emissions into the air to affect our atmosphere. Activities that adapt to the environment include technological innovations and changes. Technological innovations include things such as irrigation, fertilizer use, or building design. The process of adaptation of innovations is organic and taken up by different individuals or groups at different times. This creates heterogeneous land use and technological deployment patterns. UEM can affect business, civil society, government, and nonprofits, depending on their activities. In some ways, it is a result of the current dominant paradigm for treating the environment. This paradigm is dominated by pursuit of economic growth, ignorance of ecosystem services, and disregard for environmental impacts. UEM activities do not necessarily have a negative impact on the environment, but rather occur as a result of normal practices and not activities intentionally meant to manage the environment. This includes adaptation to environmental conditions.

Application in Berber Village of Ait Zitoune, Morocco

There are several factors of unintentional environmental management in Ait Zitoune that eventually caused the erosion challenges. The employment of agriculture
itself was a large environmental change agent that altered the environment. Fields changed land use from dry lands to cropland. Berbers planted native crops in new concentrations but also introduced new species to the environment. These species were not adapted to the environment, requiring the use of irrigation systems.

The complex irrigation system was a designed innovation that allowed farmers to increase the productivity of their lands. Built irrigation was a technological innovation deployed to adapt to the arid environment to increase water availability and reliability. The construction of the built irrigation system indicated a high level of cooperation in the creation of a civil group to increase local well-being. Only by working together were certain farmers and villages able to create the complex system. The new irrigation system would bring community-wide benefits and required community-wide collaboration. Communal environmental management was evident. The terraces on many hillsides indicated a high level of inter-generational cooperation, due to the difficulty inherent in maintaining them over time. The flood irrigation adaptations were location specific technological innovations that allowed individual farmers to best use water from rivers.

Unintentional Environmental Management can cause the tragedy of the commons. The case of Ait Zitoune shows why. The common pastureland in the areas has been grazed for a long, unknown amount of time. When livestock numbers were low, the environment was not heavily impacted. Research suggests that vegetation in the Atlas Mountains is “resilient until high levels of use” (Funnell and Parish, 93). As population grew, the Berbers started grazing more and more livestock on their lands. This began to alter the land and degrade the environment. The tragedy of the commons occurs when actors practice unintentional environmental management, changing the commons
resource because of some other activity. This is not to say that UEM will inevitably lead to environmental degradation. In Can Tho, adaptation and organic response to local environmental conditions was done to allow people to live there. Their actions did not actually change the environment and in some ways improved it.

In Morocco, national government is playing an active role in addressing the erosion challenges around Ait Zitoune. Several miles upriver from Ait Zitoune the mountainsides are covered by stands of trees. To say it is forest would be inaccurate. All of the trees in this several hectare stand were the same species and the same age. There were no plants growing underneath the tree canopy. I asked L’Haucine what this was. He told me that the government has come in to plant trees on degraded land. By planting trees they hope to reduce erosion and restore the water management ecosystem service naturally provided. L’Haucine further told me that the government is encouraging local people to participate in the reforestation effort due to the benefits it will bring.

… and what of the Berbers?

Population growth is not the only environmental threat to communities in the High Atlas. A major threat is climate change, an external disruptor. The Tragedy of the Berber Commons was caused by the activities of the Berbers themselves, notably population growth and increased use of sparse resources. The problems caused by this internal disruptor, while daunting, can be solved by actions from Berber society or the Moroccan government. Reforestation projects have already begun to reverse environmental degradation in some areas. Climate change is a threat caused by external forces over which the Berbers have little control. They produce negligible emissions and,
unlike Inuit communities, have no political ability to react. The people living in the fragile arid environments already face environmental challenges from the local geography and internally caused environmental degradation. Changes in precipitation patterns and temperature could severely threaten the Berber society in the High Atlas, who is already ecologically vulnerable. There is no way to predict what will happen with Ait Zitoune.

Conclusion

The case of the Berbers has several important takeaway points. Berber agricultural irrigation practices demonstrate the high value that is placed upon water. This civil society recognizes the benefits of water as an environmental resource and have adapted accordingly. The challenge arises from a change in the status quo in the form of population growth. Population growth put pressure on land used for grazing. In addition to providing grazing, these lands provided valuable ecosystem services, including supporting water supply. The value of these services was not evident until after the damage had been done. Overgrazing stripped the hillsides bare, resulting in severe erosion. The value of ecosystem services was not apparent until the damage from environmental degradation was actually occurring. Negative consequences from environmental damage are often not visible until they are absent. If civil society could predict the threat that land degradation posed to agricultural stability in the form of water retention it may have been able to respond differently and proactively. In one sense, the Berber society and its challenges are representative of global society. Failure to properly realize the true value of environmental resources and services will lead to behaviors and
norms that diminish that value, with negative consequences for society. The environmental imperative is to act.

This case is also important because it demonstrates how structural traits of sectors determine their ability to deal with environmental valuation challenges. Berber civil society organically recognized and adapted to the high value of water. Without population growth, their system was functional and sustainable in the long term. Population growth acted as internal disruptor that civil society was unable to cope with. The Berbers created the *Agdal* institution, over a long period of time, to govern common land. This institution was not able to adapt to pressures from a growing population and was an ineffective tool in governing the commons. Civil society, as an actor, failed to manage its environmental resources. Intervention by an actor from another sector was required to begin to remedy the damage done. Whether the national government’s actions were effective (and whether government is the best way to address the damage done) remains to be seen. The following case studies all address actors that are successfully dealing with environmental valuation challenges. This is not say that civil society is unable to successfully deal with valuation challenges or that it does not have a role to play in creating the new environmental paradigm. Can Tho’s ability to adapt to its environmental conditions shows civil society’s resilience and organic adaptability. Rather, civil society has role to play along with actors from other sectors to address environmental valuation challenges.
In 1916 a man walked into a butcher shop in Cape Town. He proposed a trade to the shop’s owner – his farm for the shop. The butcher, Charles Back immigrated to South Africa as a political refugee from Lithuania. He worked various jobs around the city, including working on land reclamation and being a delivery boy, before obtaining a butcher shop. Sensing an opportunity Back took the man’s offer and made the trade. Taking control of the farm, Back soon started planting grapes. He sold the grapes and wine to the monopoly government owned distributor. After the monopoly was broken up, the wine was sold under the label Back’s Wine in the fifties and sixties. Selling the brand name, the Back family started a new label, Backsberg Estate Cellars. Today, Backsberg is a medium sized wine producer that made just under a million bottles of wine last year. Backsberg’s operations are notable for an environmental management system that reduces their ecological footprint. Backsberg winery illustrates how businesses can reduce their environmental impact while realizing financial savings and discovering new sources of business value; further, Backsberg’s success in
environmental initiatives indicates the effectiveness of an organizational environmental champion, in this case the owner, Michael Back.

Backsberg lies on the edge of Stellenbosch, in the Paarl province, of South Africa. Located about 30 miles west of Cape Town, this region is wine country. Wineries fill the valleys from mountain to mountain. The wine produced in this region is behind South Africa’s recent surge into a source of high quality international wine. The climatic conditions here are just right to produce grapes with the needed quality for wine making. In September 2011, I visited Backsberg Estate Cellars and met with Harry Haddon, marketing coordinator, who told me about Backsberg.

Backsberg Estate Cellars covers 230 hectares, with almost 100 hectares under vine. Wine grows on grape vines, a perennial plant. This means that you cannot practice crop rotation. In fact it takes several years from when the vine is planted to when it starts actually producing grapes. Backsberg does all of its wine making on site, including storing wine in barrels and fermentation tanks. This gives them a large amount of control over their environmental impact as they control most of the processes of production. They raise the grapes, make them into wine, and then sell the wine. Recently, owner Michael Back has acted as an environmental champion in encouraging Backsberg winery to go carbon neutral. Implementing a certified environmental management system,
Backsberg began to identify ways to reduce their environmental impact. It pursued a number of initiatives and soon found that many activities helped the firm cut costs by saving fuel and discovering new methods of production.

**Wine and Environmental Protection**

The global wine industry has a particular interest in preventing environmental change. The relationship between wine production and the environment is bidirectional: the production process impacts the environment and environmental conditions determine production levels (López-Valeiras, 187). This bidirectional process can be external or internal. Worldwide environmental change is an external threat that can significantly impact wine production. The current and predicted “changes which are taking place in the world’s ecosystems will affect wine production worldwide” (López-Valeiras, 179). Wine is unique compared to many other crops because it requires specific climactic conditions. “Changes in [global] average temperatures” can impact “important aspects of wine production” such as the varieties of grapes that can be produced in a specific geographical region” (López -Valeiras, 182). Unlike the Berbers, wine producers do contribute to greenhouse gas emissions. Already there are signs that climate change is beginning to occur. “It seems to be the case that on average we are getting warming, we are having less rain,” said Haddon. “It’s just a general perception right now, but that seems to be the case.” Wineries’ activities are contributing to the external threat of climate change which could cause significant disruptions to wine production.

In addition to contributing to climate change, wine production can have significant impacts on the local environment. Pesticide use can negatively impact water
quality (Hildebrandt). Furthermore, wine production can also have negative impacts on the quality of “soil, air, food and nature in general” (López -Valeiras, 183). In Stellenbosch, the premier wine country of South Africa, there are other negative environmental impacts. The cape region is home to one of the most biodiverse areas in the world called the Cape Fynbos Plant Kingdom. This region has almost 6,000 endemic plant species; this means that they are found nowhere else in the world (Fynbos Vegetation). Most of these plants are flowering plants, with very few endemic trees which is why the region has received “the title of the ‘Cape Floral Kingdom’ from the international botanical community” (Fynbos Vegetation). Wine production is having a negative impact on this biodiversity hot spot as monoculture vineyards replace local diversity. The wine industry faces a number of impacts from environmental change while at that same time its proliferation is having negative ecological ramifications.

**Environmental Management: A Strategic Level Consideration**

The way in which the wine industry manages the environment is critically important to the financial and business success for wineries. This means that the way in which wineries manage their activities and impacts on the environment is a “fundamental aspect of business strategy” and key in determining “financial success” (López -Valeiras, 180). Lopez et al. identified two critical reasons that companies should be aware of their environmental performance: regulatory compliance and social reputation from environmental impact (183). Additionally there are real business ramifications from changing climates. The long-term impact of climate change could significantly alter wineries’ ability to adapt. If the average temperature of the Cape wine region increases
enough it could make the region inhospitable to future wine production. How wineries address their environmental challenges will determine their future production, profitability, and social license to operate.

The need to address environmental impacts and change is increasingly a key aspect of business strategy for wine companies. This strategy starts at the fundamental level of business. The “introduction and use” of business management systems begins with the creation of a company’s “mission, vision, and values as determined by the managers” (López-Valeiras, 181). Backsberg’s environmental commitment begins with the owner, Michael Back. When asked why Backsberg has committed to environmental protection, Haddon said, “it is Michael’s vision” (Backsberg Interview). This vision led to the creation of a “Statement of Environmental Commitment” which describes how environmental protection fits in with its business operations (see below). This statement outlines business goals with the ultimate aim to “limit environmental damage,” discontinue or reverse “existing practices which are harmful the environment” and to be an industry leader in environmental care. Commitment to sustainability at a strategic level will ingrain environmental care into normal business practices and values. When directed and implemented properly this strategic commitment can have a significant

Backsberg’s Statement of Environmental Commitment:

Backsberg will monitor and re-evaluate on an ongoing basis its use of land, buildings, materials, and other resources, constantly looking for and implementing ways to limit environmental damage. Wherever possible, any existing practices which are harmful to the environment will be discontinued or reversed over the coming years. Backsberg will remain leaders in environmental care.
Backsberg’s strategic commitment guides their implementation of environmental initiatives while still considering the impact on the bottom line. Backsberg Winery aims to develop solutions to environmental challenges which are “practical, implementable, results driven, and which have a payback in the medium term” (Backsberg Estate Cellars). Recognizing that environmental commitment can only happen if a firm stays in business, Backsberg has focused on environmental initiatives that are cost effective.

**Green Innovations and New Ways of Doing Business**

One method that Backsberg has used to maintain its environmental commitments has been the reinvestment of savings. Many of the environmental actions it is taking, such as energy efficiency, save it large amounts of money. In order to reduce the amount of glass used and produced by their activities, Backsberg reduced the weight for each bottle from 654 grams to 464 grams. This decreased the amount of glass brought in, processed, and shipped out by 75 tons per year. This created savings by reducing raw material needs and reducing shipping costs from reduced transport weight. By reinvesting the savings into converting the cooling system for their red fermentation tanks from refrigeration to using...
naturally cooled dam water, Backsberg is able to continue its environmental commitments. Savings from previous environmental initiatives funded further initiatives, which create additional value. This method not only ensures that environmental management is sustainable but also decreases costs as a financial barrier to action.

One change that has profoundly affected Backsberg’s operations is changing the vineyard layout model to the Lyre system. Backsberg considered three different options for their vineyard layout. The first layout is the standard, or normal, layout. This involves placing vine rows 2.2 meters apart. The second is the narrow row layout. The narrow row system consists of vine rows 1.8 meters apart. The final system is called the Lyre system. The Lyre system involves the double trellising of vines to maximize their area while minimizing the number of rows.

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Originally, Backsberg departed from using normal row spacing for their vines, instead using narrower rows. This was intended to improve the quality of the wine and the flavor concentration “by increasing the vine density and thus hanging less fruit per vine” (Backsberg Estate Cellars). Backsberg changed their key performance indicator (KPI) from tons per hectare to kilograms of fruit per square meters of canopy. This KPI recognizes that a vine’s photosynthetic capacity is determined by its canopy surface. In layman’s terms, this means that wine production is determined by how many leaves there are and not the amount of land under cultivation. Switching to this metric led to
Backsberg implementing the narrow system. Table 1 illustrates how the new metric system applies to different types of cropping methods. The standard model of vineyard layout has approximately 10,000 square meters of canopy per hectare. The narrow row model increases this available area to 12,222 square meters of canopy per hectare, increasing production level per hectare. This increase in canopy cover came at a cost, however. The amount of operating meters for vehicles increased from 4500 to 5500 per hectare. Operating meters is a key performance indicator that indicates how many meters of travel are required to grow a hectare. The higher the number the more labor and fuel required to raise a hectare of vines. The implementation of the Lyre system changed this model. The Lyre system maintained the increased canopy coverage at 12,222 square meters per hectare. However, the Lyre system reduced the operating meters by half, to 2700 meters per hectare. The impact is significant. Not only is the “installation cheaper” for the Lyre system, but also “the requirement for tractors and operator time in performing the various mechanical functions in the vineyard is reduced” (Backsberg Estate Cellars). Changing a key performance indicator allowed Backsberg to change its crop planting method and realize significant cost savings.

Complementing the adoption of the Lyre system, Backsberg has focused on reducing vehicle use and size. When possible Backsberg purchases smaller vehicles because purchasing smaller reduces gas consumption and initial cost. For Backsberg smaller tractors cost “less than half” the cost of big tractors and are also more fuel efficient (Backsberg Estate Cellars). By modifying the spray rig for a tractor, Backsberg was able to spray an additional row each pass. “Basically, instead of doing two runs to
spray, we are just doing one run of our tractor,” according to Haddon. This led to fuel savings of “at least 40%” (Backsberg Estate Cellars).

Even though financial considerations play a role in shaping Backsberg’s environmental initiatives, Backsberg also implements initiatives that have no financial benefit. Backsberg has set aside 10% of its land area to help conserve the endangered Fynbos biome. This biome is part of the Cape Floristic Kingdom (see Figure 8. Cape Floristic Kingdom), a key reserve of biological diversity. This kingdom is “home to the greatest non-tropical concentration of higher plant species in the world… and holds five of South Africa’s 12 endemic plant families and 160 endemic genera” (Cape Floristic Kingdom). Backsberg’s conservation activities have involved protecting about 30 hectares of land of this biodiversity hotspot. Backsberg’s obligation includes combating invasive species through cutting down alien trees. In order to reduce Backsberg’s emissions and reduce offset requirements, Backsberg has set aside an additional 10% of its land for the production of a renewable energy biomass crop. This land is managed by a partnership with the University of Stellenbosch, which uses the land for research activities. One of the potential biomass crops are imported Eucalyptus trees. In order to avoid reducing the water table by producing biomass crops on site, Backsberg irrigates this area with winery wastewater, as part of their wastewater management program. These activities ensure long-term conservation of a key biological reserve and also provide a potential method to reduce carbon emissions.

Figure 8. Cape Floristic Kingdom
**Capability to Execute Green Initiatives**

A unique aspect about Backsberg’s operations, and wineries in general, is the high level of control over inputs, grape production, manufacturing process, and sales. Backsberg owns the land which produces the grapes, does its own manufacturing, and is in charge of its own distribution. This vertical integration gives them a large amount of control over their business operations. Irrigation provides an example. Like many wineries around Stellenbosch, Backsberg practices drip irrigation to reduce water consumption. Backsberg has its own water supply – dams on site. This creates opportunities for environmental initiatives that less vertically integrated businesses and industries do not have. For example, owning their dams allows Backsberg to use the water to regulate the red wine fermenting tank temperature. Controlling the manufacturing process allowed Backsberg to reduce the amount of glass consumed per bottle. This vertical integration means that Backsberg is able to have significant control over all of the environmental impacts of its products. Combining this control with environmental stewardship is a key factor to the success Backsberg’s many different environmental initiatives. It does not have as many suppliers or producers to deal with.

**Environmental Champion**

Backsberg’s owner, Michael Back, is key to the success and implementation of environmental initiatives at the winery. “We are looking forward and asking ourselves, ‘How do we keep making this product and doing this business that we are doing while maintaining an environmentally sensible way of doing it?’” says to Haddon. “That is really driven by Michael Back, the owner of the farm.” Michael Back is an organizational
environmental champion. An environmental champion is an individual within an organization who takes personal responsibility to guide their organization in reducing environmental impacts. By advocating for sustainability, these champions ensure that environment is a consideration in business or other operations. They are drivers of organizational change, and are often most effective by making the business case for sustainability: cost reduction and new sources of value. Environmental champions can be present across all sectors. Michael is a champion because of his continued effort and support of environmental activities. As the owner, Michael is especially able to implement changes. He has the final say. This has enabled him to work with different aspects of the winery to help reduce different environmental impacts.

The Impact of Environmental Initiatives on Backsberg

Backsberg’s environmental commitment improves business performance and value across a variety of indicators. Financially, the transition to sustainability has not threatened the company. In fact, many actions taken by Backsberg reduce costs. Many of their actions are win, win, win. Increasing efficiency reduces costs, a win for the bottom line, and reduces greenhouse emissions, a win for the environment. Using a dedicated environmental management system has allowed the company to assess different aspects of business operations and identify new areas for improvement. In addition to the financial value, a commitment to environmental care has positive intangible business benefits. It brings international recognition and reputation. Backsberg has won awards for its environmental commitment. Within South Africa, Backsberg is one of only thirteen wineries to receive the Biodiversity and Wine Initiative’s Champion status. Backsberg
even received a visit from the South African Minister for Environmental Affairs and Tourism. The Minister particularly highlighted “the practical and innovative way in which they are tackling existing problems,” “their willingness to share their knowledge,” and their “becoming the first carbon neutral wine estate in the country” (Backsberg Estate Cellars). Media attention has been extremely high. Backsberg and its story have been featured many times in local, national, and international press, including the BBC.

Environmental initiatives have not had an impact on the quality of wine. Backsberg won eighteen awards for specific wine vintages between 2007 and 2008. Overall, Backsberg’s environmental activities have had a positive effect on their operations.

In the future, Backsberg may be able to leverage their environmental stewardship and international recognition as a marketing tool. To a certain extent, they already do. Each wine bottle has a carbon neutral label. International recognition has increased Backsberg’s international profile and reputation. As Haddon noted, “that allows us to get a lot of free press.” Haddon provided me with a list of media mentions that included over 64 stories, articles, and blogs about Backsberg and their environmental commitment. This environmental press coverage differentiates Backsberg from the many other wineries in Stellenbosch. However, marketing is not the driving force for their environmental commitment. This means that Backsberg avoids the marketing dangers from green washing. “Our environmental commitment is much more of an energy issue than a selling point,” according to Haddon. This demonstrates a profoundly important lesson for business managers concerned about environmental protection: you can gain significant value from greening operations even if you do not market your product as green. As consumer choices change the value of environmental stewardship has the potential to
increase demand for Backsberg’s wines. For now, Backsberg is realizing major benefits from their environmental program through internal business practices. Even if consumers do not demand green products, a business can still benefit from an environmental management system.

**ISO 14001: Environmental Management System**

Backsberg has an internationally certified Environmental Management System (EMS). This system is developed and operates under the ISO 14001 standard. “Environmental Management Systems” emerged as tools to ensure an “integrated and proactive approach to environmental issues” (Barrow, 69). They can be used to help organizations, especially industry, “comply with environmental regulations” or “obtain technical or economic benefits” (Barrow, 69-72). International certification of an organization’s EMS ensures the effectiveness of the system. International standards provide “benchmarks” that are intended to “ensure ongoing objectives are set and met” (Barrow, 60). A key aspect of the ISO 14001, and many other EMS certifications, is that of continual improvement. The standardization that international certification provides to environmental management systems ensures implementation of processes that continually reduce a company’s negative environmental impact.
The International Standard Organization created the 14001 standard to establish the requirements for an Environmental Management System (EMS) certification. The International Standard Organization is “the world’s largest developer and publisher of international standards” (ISO About). The 14001 certification does not prescribe a specific management system or method. Rather it ensures that an organization’s EMS meets five criteria. First the organization must create and implement an environmental policy that has senior management commitment. Second they must adopt a planning process “that identifies all of the environmental issues of a facility’s operations” to shape “objectives and targets for environmental improvements” and serve as the foundation of environmental programs (Link and Naveh, 509). Third, the standard requires assignment of environmental management responsibilities and training for all employees to raise their awareness of environmental issues and their role in the environmental management system. This step deals with the implementation of identified actions and programs. Fourth, the organization must ensure that there are systems for corrective action and auditing, to ensure results. Fifth, the environmental management system must be reviewed on a regular basis by top management “to assure continuous improvement” (Link and Naveh, 509). The number of organizations with certified 14001 systems has grown substantially, likely due to being more “user-friendly and easier to understand” compared to other systems (Link and Naveh, 509). Additionally, the system is modeled

ISO 14001 Core Sections
1. Environmental Policy
2. Planning
3. Implementation and Operation
4. Checking and Corrective Action
5. Management Review

Source: Introduction to Environmental Management
off of the widely adopted ISO 9000 series, which deals with quality management. This has made it very easy for organizations with ISO 9000 standards to adopt the new 14001 standard.

ISO 14001 works through the principle of standardization. Standardization is a principle, “derived from scientific management,” that contends that “routinization is the key to coping with complexity” (Link and Naveh, 509). Basically, the certification system works on the premise that an environmental management system should have the basic management structure as outlined in ISO 14001. This is true regardless of where the system is implemented, be it a winery or a cruise ship. In one sense, that is the power and weakness of the ISO 14000 series. The general management model is applied to many different organizations, which then adapt the model to their specific circumstances. Because the implementation of the certified system depends on individual circumstances, the result of an ISO 14001 certification can vary depending on the level of commitment and the dedication of managers in executing the organization’s environmental policy.

Effectiveness of ISO 14001

The ISO 14001 standard has the potential to be a strong tool to improve an organization’s environmental performance. Already it is being adopted by many organizations around the world. Considering the high level of adoption, this standard could become a very strong tool to promote environmental management and increase sustainability worldwide. However having the standard does not actually lead to positive environmental outcomes. An organization can implement the ISO 14001 standard without integrating its principles into everyday practice. When incorporated into an
organization’s operating system, the environmental management system can become “necessary for performing operational activities” (Link and Naveh, 510). Merely obtaining the certification does not guarantee the effectiveness of the system. A study by Link and Naveh of forty organizations with ISO 14001 certification determined that if the system “becomes part of the organization’s daily practices” it leads to “better organization environmental performance” (508). Integration into daily business practices will insure the best results by increasing explicit knowledge about the environmental impacts of a business’ operations. Explicit knowledge are “words, numbers, diagrams, figures, formulas, and blueprints” that reflect the results of a functioning EMS. These results allow employees and managers to identify areas for improvement and analyze the costs and benefits of action.

Several studies have attempted to determine whether ISO 14001 certification leads to improved business and environmental performance. Link and Naveh examined ISO 14001 certification in forty organizations across Israel. They found that although adoption of ISO 14001 into daily operating procedure did not improve business performance, it significantly improved environmental performance without harming business performance. The implications of this are large. Effectively, businesses implementing and embracing an ISO 14001 EMS will be able to improve their organizations environmental impact without impacting the bottom line. We can reduce our environmental impact using an EMS with no net cost. However, Link and Naveh’s definition of business performance focused largely on tangible and financial benefits. Their measures of performance were gross profit margin, investment in R&D, sales, sales per employee, and business with foreign organizations. These measures do not capture
other intangible benefits of improved environmental performance, such as decreased regulatory exposure, increased worker satisfaction, increased reputation, and a societal benefit from reduced environmental damage. Considering these intangible benefits makes the adoption of an EMS even more attractive.

One cause of effective execution of environmental management, according to the Israeli study by Links and Naveh, is increased employee discretion; assigning specific responsibilities to employees gives them the flexibility to perform environmental duties as they see fit. An environmental champion in an environmental management role that has flexibility in carrying out responsibilities can be an effective tool at reducing environmental impact. ISO 14001 can be thought of as a system that enables environmental champions to improve business performance. An organization does not need to adopt ISO 14001 to realize that same value. Rather the organization needs to recognize how the system really works: it makes environmental issues a senior management issue while providing environmental champions with the ability to implement new practices. If an organization works to enable environmental champions, they can reap the rewards. If the organization is a business, those rewards can positively affect the bottom line and uncover new sources of business value.

Environment and the Creation of New Sources of Business Value

When addressed with questions about environmental performance many companies argue that reducing their environmental impact will create an additional business cost that will reduce their ability to compete. This may be true for certain industries. However, Backsberg winery illustrates the benefits that a commitment to
environmental stewardship can positively affect business operations. There are several steps to creating sustainable value. Perhaps most important benefit of adopting an environmental management strategy is the development of green management competencies.

Environmental management can be an important part of a company’s strategic plans. The upcoming environmental challenges of the 21st century mean that industry may radically change in the future. Business should approach these changes as both an “enormous challenge and an enormous opportunity” (Hart, 67). Companies must move beyond greening; they must create internal and external strategies that enable them to cope with the upcoming demands of sustainability.

The most important benefit of adopting an environmental management strategy is the development of green management competencies. A competency allows an “organization to tie together complementary and co specialized capabilities” that evolve organically and “are difficult to imitate” (Marcus and Fremeth, 22). Basically, over time a commitment to greening operations makes a company good at being green. A properly integrated environmental management system that impacts daily operations leads to superior performance. Newcomers without these competencies are at a disadvantage when it comes to environmental management activities. Green competencies are unique among businesses because the results of strong environmental management are public goods – goods “whose full value a firm cannot entirely appropriate” (Marcus and Fremeth, 22). As green management creates public goods, government has an interest in promoting green management. The relationship between government and business on environmental issues is complex and includes “legally binding mandates,” voluntary
agreements, “grants, subsidies, transfers, taxes,” and other activities (Marcus and Fremeth, 23). Developing competencies in environmental management can give businesses competitive advantages. An example would be regulation. If government institutes regulatory requirements that promote environmental protection, companies that have developed green competencies would be able to meet new requirements more efficiently and more quickly than competitors. Considering the potential for carbon regulation, carbon management now can create future long-term competitive advantages.

**Carbon Neutrality**

Backsberg was the third winery in the world to be certified carbon neutral. Carbon neutral means that any carbon dioxide produced by operations is offset by projects or programs that sequester, or uptake, the same amount of carbon. Being carbon neutral does not mean that an organization produces no carbon emissions, but rather that the carbon used by the organization cycles. Cycling carbon ensures that it does not remain in the atmosphere and contribute to climate change. While the carbon in carbon neutral refers specifically to the chief anthropogenic global warming agent carbon dioxide, carbon neutrality includes all greenhouse gasses. The 2007 carbon audit for Backsberg was completed by Promethium Carbon, a South African consulting firm. Performing a carbon audit requires an analysis of direct and indirect emissions resulting from operations. Quantifying the amount of greenhouse gas emissions allows year to year tracking of data. An organization that wants to be carbon neutral must undergo annual audits to ensure that they are carbon neutral each year. After calculating the annual
carbon footprint, an organization can enact appropriate offset projects to sequester their annual emissions.

The first aspect of the carbon audit at Backsberg determined the boundaries of Backsberg’s operations to allow for an analysis of direct and indirect carbon emissions. Promethium Carbon used ISO 14064-1 to guide their analysis. Using this standardized protocol directed Promethium’s audit and accounting procedures. ISO 14064 “allows the setting of organizational boundaries” to be based on either “the control principle or the shareholding principle” (Carbon Footprint, 7). The control principle counts all emissions by activities that the audited organization controls. The shareholding principle counts emissions proportional to the share an audited organization owns. Backsberg’s audit was based on a control method. In addition to calculating emissions from their own operations, Backsberg also included emissions from “deliveries to the estates” and “distribution to the client base” as they had control over these operations (Carbon Footprint, 5). This means that Backsberg is taking account of all emissions caused by their operations, including transportation of materials from their suppliers and delivery of wine to their customers. This approach, accounting for indirect emissions, allows Backsberg to have a more comprehensive view of the emissions they are responsible for, while enabling Backsberg to find additional areas to cut emissions. The audit itself analyzed direct and indirect emissions resulting from activities that Backsberg controlled. Direct emissions include onsite combustion of carbon emitting fossil fuel for vehicles or electricity, and fugitive emissions from fertilizer. Indirect emissions include the emissions from electricity by the coal based South Africa national grid and emissions from outsourced activities. By including indirect emissions Backsberg is “in compliance
with the gate to gate principle” which leads to a more “complete picture of the baseline GHG footprint” (Carbon Footprint, 10). After establishing what emissions to count, the audit of actual emissions begins.

Backsberg’s GHG footprint in 2007 was 1,867 tons of carbon dioxide equivalent (CO₂-e). The largest share of this came from indirect emissions from electricity. Backsberg purchases electricity from Eskom, which produces 95% of South Africa’s electricity (“Company Information”). This electricity is “based on low grade coal” which means that emissions for this energy source are “very high” (Carbon Footprint, 11). Of Backsberg 1,876 tons CO₂-e, 70%, or 1,245 tons, came from electricity consumption. This is equivalent to an estimated 1,132 trees of carbon (Carbon Footprint, 14). After electricity the next largest contributor to Backsberg’s footprint is production distribution and delivery of raw materials, together making up 23% of Backsberg’s footprint. Based on these numbers, the areas with the most carbon reduction potential are electricity consumption and transportation to and from the estate. The ultimate goal of a carbon footprint is to identify areas to reduce emissions. The 2007 carbon footprint was higher than the 2006 level of 1,688 tons of CO₂-e. This was “due to expansion on the Backsberg estate” which increased electricity and fuel consumption; “excluding supplies delivered and the additional activities” in 2007, Backsberg’s carbon footprint is actually less than 2006 (Carbon Footprint, 2007).

In order to become carbon neutral, Backsberg needs to identify and implement reduction and offset opportunities for each ton of CO₂-e emitted. Consumption of electricity was the largest contributor to Backsberg’s footprint; reducing electricity consumption has the largest potential to reduce emission levels. Some of Backsberg’s
environmental initiatives are beginning to address this. As Promethium notes, “the biggest use of electricity seems to be the chilling facilities” used for red wine fermentation (Carbon Footprint, 21). Using geothermal heat pumps that take advantage of Backsberg’s water pond’s constant temperature can significantly reduce carbon emissions. Not only does this system reduce emissions, it cuts down on electricity costs. After reducing future carbon emissions the next step to becoming carbon neutral is offsetting current emissions. Promethium identified several opportunities for offsetting: “installation of solar geysers in a nearby community,” “installation of solar cookers in a nearby community,” additional tree planting, and purchasing of voluntary emission reductions (Carbon Footprint, 24). These range in costs of emissions abatement from 50 rand per ton of CO₂ (about $6.25) for voluntary emissions reduction offsets to 91 rand per ton of CO₂ (about $11.40) for solar cookers. By offsetting its emissions, Backsberg is able to bring its net climate change impact to effectively zero. Developing carbon management competencies now also gives Backsberg a future advantage over competitors if carbon regulation is implemented. Most important, if other businesses and wineries follow Backsberg’s leadership, the danger that climate change poses to the South African wine industry will decrease.

Reducing Backsberg footprint means that Backsberg’s environmental impact is being reduced because of the internalization of the costs of production. Pollution acts as an externality in that it externalizes the costs of production away from the producer. These impacts have negative consequences for society at large. By internalizing the costs of production, Backsberg is increasing the cost of its product. This creates a profit incentive to reduce the environmental damage associated with the cost of its product. The
negative impacts of externalities can be alleviated if “decisions makers” are responsible for the full “costs and benefits they bring to society” (Anderson, 57). The problem is that Backsberg’s actions are voluntary. The likelihood of Backsberg’s internalization being repeated by other companies is unlikely.

**Backsberg Reflection**

When Charles Back traded his butcher shop for the land that would become Backsberg Estate Cellars, the environmental movement was not even in its infancy. Today, less than 100 years later, Backsberg is a global leader in sustainable wine production. Much of this is thanks to the initiative of environmental champion Michael Back. Implementing an environmental management system and making environmental stewardship a priority has shaped the future of this South African winery. Backsberg’s initiatives significantly reduce its environmental impact while increasing the winery’s international standing. Furthermore, Michael’s efforts have allowed Backsberg to identify and take advantage of new sources of business value. Promoting efficiency has reduced fuel and electricity consumption. At Backsberg, environmental champion Michael Back’s drive and the implementation of an ISO 14001 environmental management system has internalized the external costs of wine production while realizing new sources of business value from embracing environmental sustainability.

**Conclusion**

Backsberg Estate Cellars demonstrates how businesses are able to use their profit motive to reduce the negative impacts of externalities when these costs have been
internalized into the costs of production. Externalizing costs are an effective way for businesses to reduce the costs of their product by shifting that cost to general society. This allows them to undercut their competition. Backsberg’s adoption of the ISO 14001 Environmental Management System provides standardization that enabled the identification and implementation of initiatives, some of which internalize the costs of production through resource efficiency. Resource efficiency is an effective tool because it allows a business to reduce their costs and environmental externalities at the same time. Backsberg’s commitment to carbon neutrality increases their incentive to reduce carbon emissions by providing monetary incentives in reduced offset costs. Backsberg also illustrates how businesses are able to gain significant non-financial value from environmental initiatives. Backsberg has received international attention and increased brand value through its commitment to sustainability.

The business sector can pursue actions that preserve the environment without damaging the bottom line. However, the case for environmental protection becomes more challenging when the benefits are hard to quantify or capture. Backsberg’s commitment to protecting the Fynbos biome is a good example. Biodiversity is a resource whose value is difficult to measure. Even if the value of biodiversity can be calculated, it is extremely difficult to capture in the short term. This means that even though the resource has value, that value cannot be obtained immediately. This poses challenges for businesses whose motivation is to make a profit. If you cannot monetarily capture a value, it is hard to justify preservation. Backsberg commitment, while laudable, is entirely voluntary and does not provide tangible business benefits. It is not likely to be repeated by other businesses. The major limitation to business activity is their motivation: profit is the
reason they exist and actions which do not lead to profit are hard to justify. This is why other actors are needed to address environmental valuation challenges that are difficult to capture.
Chapter 3
Commitment and Advocacy

“The world has woken up at the same time. In the last twenty years there has been this global wake up to ‘hold on a sec guys, we are running out of all of these resources that we had thought were endless.’” —Jax Bergersen, Head of Kuranda Conservation Community Nursery

Kuranda is a small town in the Northeastern section of Queensland, Australia. The major biome is tropical rainforest; the area is part of the Wet Tropics of Queensland World Heritage Area. This rain forest is unique: separated from life on other continents by millions of years of continental drift, species on the Australian continent have evolved completely differently from anywhere else. While the Cape Floristic Kingdom has the highest level of floral diversity, it is not the most biodiverse area on earth. The Wet Tropics of Queensland are the second most biodiverse area on the face of the earth, after the Amazon rain forest. In Kuranda, I encountered a non-profit environmental organization dedicated to preserving biodiversity. This organization, officially called the Kuranda Conservation Community Nursery, was founded and is operated by Jax Bergersen, an Australian originally born in Melbourne. After her kids went to college she went north to live in the warmth of the tropics. Jax eventually arrived in Kuranda and bought some land. Kuranda Conservation was born out of a desire to protect the vital biodiversity of the Wet Tropics; a key conservation tool has been the use of the charismatic Southern Cassowary (Casuarius casuarius). As a charismatic mega fauna and keystone species conservation efforts for this bird have larger positive impacts on the
Kuranda Conservation Community Nursery demonstrates how the mission-driven structure of the nonprofit sector enables nonprofits to address environmental valuation challenges.

Wet Tropics World Heritage Area

In 1972, Australia and other countries signed the World Heritage convention which outlines conservation and preservation of unique areas of manmade and natural heritage. This convention recognized encroaching threats upon heritage sites. Natural areas were an important part of the convention’s goals; the convention included areas that consisted of “physical or biological formations” that held “outstanding value from the aesthetic and scientific point of view” (Convention). This convention eventually led the national and state governments to create the Wet Tropics Management Authority to fulfill Australia’s obligation “to protect, conserve, present, rehabilitate and transmit to future generations the Wet Tropics of Queensland World Heritage Area” (“About the Wet Tropics Management Authority”).

The Wet Tropics were chosen because they are ecologically unique. Lying north of the Tropic of Capricorn, the heritage area has 50 species of primitive flowering plants that grow nowhere else, 13 endemic mammal species, and is home to nearly half of Australia’s bird species. The threatened Southern Cassowary, the third largest bird species on Earth, roams the area. Daintree Rain Forest is of particular note; Daintree is a small area that has been largely preserved since ancient times and harbors many species that provide a living evolutionary history of life on earth. Many of these plants existed during the times of dinosaurs. Kuranda lies within the Wet Tropics, in a small strip of rainforest sandwiched by the dry lands and the ocean.
Kuranda founding and history

Kuranda was officially founded on October 23, 1888 when Thomas Behan surveyed the area. A railway was built from nearby Cairns and soon Kuranda was linked to the outside world. Agriculture was the first dominant industry in town; coffee was an early cash crop, but a crop failure in 1901 due to “a severe black frost” led to a period of dominance by grazing cattle (Kuranda). Today the town is home to about 3,000 and is a rural, residential community. Tourism is powerful with both the heritage Kuranda railroad and recently built skyway gondola bringing visitors up into the mountains from the tourist attractions of Cairns, Australia. The main street is filled with tourist shops, but beyond that there is a thriving local community.

In May 2011, I visited Kuranda for my first research trip. I soon met Jax Bergersen, who brought me back to her house to give me my first research interview. We set up in her back yard on a plot of land surrounded by trees. Upon finding out that I had not eaten all day, Jax began to force feed me bread, butter, and vegemite, topped off with tea. As I ate, Jax told me about how she first came to Kuranda and became a local environmental advocate. After her kids grew up and left, she decided to head north. “Every day I got warmer and every day it got greener,” said Jax. She was entering the Wet Tropics. She started working in nearby Cairns before buying some land in Kuranda on what used to be old cattle country. In order to feed the cattle, ranchers had cleared local rainforest and planted an invasive species, called guinea grass, which overran many native species. Jax’s property was originally overrun by Guinea grass. This was the first of what was to be many encounters with invasive species in this biodiversity hotspot.
One day Jax noticed a sign saying that a subdivision was going up across the highway. “It was going to be house after house all around here,” said Jax. “Someone said go and talk to your councilman.” Jax went to her local ratepayers association, an organization that allows citizens to engage their local government. The association was split between developers and other community members; the association was unable to advocate for environmental preservation over the needs of development. So Jax decided to start her own environmental organization; she founded the Kuranda Conservation Community Nursery. Soon membership swelled to over 100 community members. While primarily based on local concerns and the desire for conservation, Kuranda Conservation plays a key role in an emerging global environmental movement. “It just so happens that this whole thing to do with climate change and carbon and land clearing has also awakened in the same time period that I have been active,” said Jax. That changing global attitude has local ramifications. “Now every tree counts,” said Jax. “We have birds that you have nowhere else. We have insects that you have nowhere else.” Today Kuranda Conservation works as a nonprofit organization to protect and preserve the unique biodiversity of the Wet Tropics.

**Kuranda Conservation Nursery**

Kuranda Conservation focuses on protecting the endangered Southern Cassowary. The Southern Cassowary is an umbrella and keystone species. An umbrella species is a species whose conservation will indirectly benefit and help conserve many other different species. A keystone species is a species that performs a major supporting role in a complex ecosystem. Its behaviors help regulate and structure ecological activity.
Protecting Southern Cassowaries will also lead to the preservation of many indigenous plants that support the cassowary. Cassowaries eat and distribute seeds from a large variety of local plants.

The Southern Cassowary (*Casuarius casuarius*) is one of four surviving members of the Casuariidae, a family of large flightless birds. Many other species of Casuariidae were killed off by human settlers. The Southern Cassowary is related to others big birds, such as Emus or Ostriches. A tall black bird, the Southern Cassowary is native to New Guinea and Northern Australia, and has been in the decline “during the last three generations” (Birdlife Fact Sheet). As I talked with Jax she told me several times that she hoped I would see one, but I probably wouldn’t. They have become much less common throughout Australia; there is no evidence regarding populations in New Guinea, making the overall health of the species hard to diagnose, although habitat loss and fragmentation due to human development severely hurt the Australian population. The New Guinea population is “heavily hunted, captured and traded close to populated areas” (Birdlife Fact Sheet). According to the IUCN, *Casuarius casuarius* is considered a vulnerable, and threatened, species. The Queensland Parks and Wildlife Service estimated only 1,500 to 2,500 individuals in Australia (IUCN Redlist). Large animals like the Cassowary are particularly dependent on large areas with which to gather many different types of seeds. Human development has decreased overall habitat and fragmented remaining habitat. As humans change and develop areas in the rain forests of Kuranda, they plant, introducing plant and tree species. Often these species are invasive and over power local biodiversity. They also introduce other pests, such as the pig. Fragmentation occurs from the
construction of infrastructure – roads, railroads, and electrical lines – which cut natural habitat into smaller pieces and limit ecological ranges.

**Invasive Species in the Wet Tropics**

A major threat to Australian biodiversity is, and has been, invasive species. The introduction of the rabbit is well known for the damage it caused; Australia went so far to build a gigantic fence to prevent rabbits from invading an entire section of the continent. Invasive species are dangerous because native species in Australia have evolved in isolation. Local plants and animals are not adapted to new browsers and predators; the ecological consequences can be devastating. In Kuranda, invasive species are dangerous to local biodiversity. “People are still a big problem,” according to Jax. People bring invasive species in for a variety of purposes, ranging from agriculture to aesthetics. When Jax first arrived she planted daisies. “When I was a little girl I used to sit out in parks and make Daisy chains. When I came up here and found this little yellow daisy, I thought, I’ll have some of that.” It turns out that what Jax planted is called Singapore daisy. “It is the biggest weed known to mankind. I planted it here and I’m never going to get rid of it. I didn’t know.” Humans have unintentionally introduced many different invasive species. Once established in the local environment, invasive species are hard to exterminate and compete with local species. Combined with human forces of development, which damage and disrupt normal ecosystem functions, invasive species drive loss of biodiversity. Occasionally the damage done by invasive species is made even worse by humans continuing to introduce the species.
The wild boar, or wild pig, (*Sus scrofa*) is an emblematic invasive species. The pig was originally brought as an agricultural animal when Europeans first began to arrive in Australia. During the 19th century, settlers spread the pig throughout the Australian continent. Pig escapees eventually ended up setting up feral colonies. “Today, up to 23.5 million feral pigs are spread across about half of the continent,” including Queensland and parts of the Wet Tropics (Feral Pig Fact Sheet). They are now declared “environmental and agricultural pests” and cause unknown amounts of environmental damage (Feral Pig Fact Sheet). As omnivores, these pigs have a flexible diet and are able to out-compete and root up many native species. Pigs fight with other species over food and destroy unique breeding locations and fragile environments. Pigs are a declared pest; they are killed and managed with a variety of methods, including air shooting, land hunting, poison, trapping, and electric fencing. Australia lacks large predators, meaning that introduced pigs do not have ecological controls that prevent their rapid spread. This invasive species poses a very high threat to biodiversity and human agriculture.

Kuranda Conservation provides pig-trapping services to combat the threat that invasive pigs place upon local biodiversity and the cassowary’s environment. Feral pigs have established populations around Kuranda and threaten the local environment. Due to the threat they pose, they have to be managed. Trapping is the only acceptable method in the rural, residential areas. Kuranda Conservation works with local residents to identify and track pigs, then places traps on private land. Landowners are taught how to notify the proper authorities or individuals when a pig is trapped who ensure the pig is killed in the most humane way possible: a bullet. Kuranda Conservation works within a network of organizations that work to cull feral pig populations and fight invasive species generally.
One of these is the Pest Management Committee of the Tablelands Regional Council, the local governing entity. This management committee brings together local stakeholders to address the problems stemming from invasive species. Members include representatives from various government agencies, nonprofits, and ranchers. This committee meets to discuss and coordinate invasive species management challenges.

**Keystone species, umbrella species, and charismatic megafauna**

The Southern Cassowaries are considered charismatic megafauna – large animals that are able to attract high levels of public attention and visibility due to their attractiveness. The beauty of these animals makes conservation activities easier as these animals appeal to the public; they are more willing to fight for a large animal than for an unnamed worm. Fortunately for conservationists, these empathetic animals play important ecological functions and roles. Charismatic megafauna are often mammals but they don’t have to be. They can include birds such as the Cassowary or Emu. They are usually keystone species. The term keystone derives from the roman construction of the arch. The arch would be composed of bricks on top of other bricks. In the center of the arch there would be a keystone, which would hold the two stacks of bricks together. The structure was stable and could support the weight of roman architectures, including coliseums and aqueducts.

The arch is a metaphor for an ecosystem. The ecology of that ecosystem can include a certain species, which keeps the ecosystem working. Often a top predator or large animals these animals maintain balance in ecosystems by providing ecological services. Browsing or hunting activities help prevent species over population. The
Southern Cassowary distributes native seeds throughout its range, covering large
distances. Due to this support role that Keystone species play, conservation activities for
charismatic megafauna can significantly benefit other communities. The term umbrella
species derives from the fact that conservation efforts to protect a species like the
Cassowary will include activities that protect the local environment and increase
biodiversity. These activities have an umbrella effect, which improves the health and
affect of conservation activities. This presents an important ecological lesson for
conservation activities: in order to protect large keystone species you must preserve local
biodiversity and ecosystems. Kuranda Conservation has a nursery that uses this lesson
exactly.

**The Use of Conservation Principles to Succeed in Mission Objectives**

One of Kuranda Conservation’s largest undertakings is a 10,000-plant nursery of
local plants. The nursery supports local biodiversity and conservation. “The purpose of
gathering seeds” for the nursery is to “restore and replenish the forests and gardens”
around Kuranda to support Cassowaries (Kuranda Conservation). Cassowaries rely upon
a large variety of local plants and seeds, meaning that preserving these plants will also
preserve the cassowary. This is an example of conservation strategy based upon an
ecological principal. The environmental impact of ecological activities is also reduced by
the growing methods that the nursery uses. Worms grown on site prepare and fertilize
soil, eliminating the need for offsite fertilizer. These worms regenerate soil by feeding on
dead matter and processing it, making nutrients more available for plant growth.
Seedlings are sold at cost to local residents who can then plant them instead of non-native
species. The cost covers only the costs of growing. By supplying local seeds and helping redistribute them, Kuranda Conservation is able to achieve several goals: restore native plant cover, stop the planting and introduction of new invasive species, and preserve the high levels of biodiversity needed to sustain cassowaries and other species of the Wet Tropics.

Cassowaries need high levels of biodiversity because of their diets. As large birds, they need to have relatively large food sources. Reducing amounts of available food through development or restricting access through fragmentation will limit accessible food. Bradford, Dennis, and Westcott in a recent study found that “during the lean fruiting season (May – July) cassowaries relied more on species that fruited continuously” for their main food sources. Things changed in months with “high fruit availability (October – December)” where annual and biennial species became more important in the diet, but still not as important of continuously fruiting species (Bradford, Dennis, and Westcott). The cassowary relies on different species for food at different times of year, meaning it needs a higher level of biodiversity to ensure seeds or fruits are available as food. The same study found evidence of cassowaries consuming over 56 plant species. A diet with a large variety of species variability, such as the cassowary, makes umbrella species important for local biodiversity initiatives.

Nonprofit Structural Driver: The Comparative Advantage of a Mission

The mission-driven orientation of a nonprofit organization allows it to change its focuses and priorities while using relevant scientific principles. Nonprofit organization and articles of incorporation and governance vary between countries and between
organizations. A general principle of a nonprofit is a mission or goal. As noted in the introduction in order to understand institutions “one needs to know what [institutions] are, how and why they are crafted and sustained, and what consequences they generate in diverse settings” (Ostrom, Understanding, 1). Nonprofits are unique due to their structure; they are “privately controlled entities” that “exist to serve a social purpose” with “public benefit” (Worth, 44). Imperative to achieving this purpose is a nonprofit’s mission. A nonprofits “mission is so central” to its activities that “all nonprofit organizations… are said to be mission driven” (Worth, 44). A mission is the reason for a nonprofits existence. Kuranda Conservation exists because of its mission to preserve the cassowary and protect biodiversity in the Wet Tropics. Nonprofits differ from governments because of how they are controlled. They are privately controlled whereas “government agencies are ultimately controlled by elected officials” (Worth, 44). One must note that “the complex and heterogeneous nature of the voluntary sector” makes a complete or through analysis difficult (Dollery and Wallis, 7). Nonprofits range in size from small organizations, such as Kuranda Conservation Community Nursery to national groups, such as the Sierra Club, to international nongovernmental organizations with a global presence, such as Greenpeace. While noting this complex nature, I focus on general advantages or limitations that nonprofits have due to their organizational structure. Nonprofits generally emerge organically as a result of either demand or supply side factors. Demand side factors constitute either a “market failure” or a “government failure,” where those respective sectors of society fail in their role and nonprofits seek to fill the gap (Dollery and Wallis, 7). These demand side factors are directly relevant to organizational analysis of environmental valuation challenges. The nonprofit
organization is needed to step in when business or government fails. Those two sectors are constrained by limitations that nonprofits are able to avoid. Supply side factors consist of “social entrepreneurship, a variety of explicit and implicit subsidies” and other tax incentives (Dollery and Wallis, 7). Kuranda Conservation emerged to advocate for local biodiversity, which consisted in protecting a public good that was originally under government’s care.

**Nonprofits and Environmental Management**

The mission-driven nature of a nonprofit gives it tremendous advantages when addressing environmental valuation challenges, as nonprofits are able to focus on specific social or environmental goals. These issues are often those that do not provide a quantifiable good or service, such as preserving the value of biodiversity. As the organizations are mission driven and goal oriented they do not have the same financial realities as business, which sell a product, or government, which has competing interests for funding. Rather, nonprofit environmental organizations are able to focus on achieving their missions and can do so where there is minimal government incentive for involvement. Nonprofits also work in conjunction with businesses and governments on a variety of activities. Backsberg worked with Food and Trees for Africa to help with its carbon offset purchases. These organizations are often staffed by individuals passionate for issues or with vested interests in their outcomes. Kuranda Conservation provides a good example. The organization attempts to preserve the local environment and biodiversity, using Cassowaries as charismatic mega fauna. Jax runs Kuranda
Conservation out of a desire to conserve the local environment and advocate for human adaptation to local environments.

The day-to-day activities of a nonprofit can vary. Commonly, many activities of non-profits are funded by donations or self-funding. Sometimes they have cost recovering measures, such as Kuranda Conservation’s selling of local plants at cost, but these organizations do not exist to sell a service or product. The output of such organizations can vary substantially, and include both goods and services. Nonprofits can focus on advocacy, grassroots campaigning, conservation, and research, among many other activities. Kuranda Conservation’s many projects and activities serve as an example. By working with the local community, Kuranda can track and protect cassowaries, be involved in local government decisions and activities, and advance its mission of protecting local biodiversity.

Public Benefits: Government Responsibility and Nonprofit Capability

In one sense, nonprofits are able to perform government-like functions: they deliver services for the public’s benefit. Championing and protecting biodiversity helps to preserve the extreme diversity and story of evolutionary history preserved in the Wet Tropics. The scientific and aesthetic knowledge that Kuranda Conservation helps steward is a benefit to all of humanity, as envisioned by the World Heritage Convention. Nonprofits do not operate in a vacuum; governments still work for the public good and often on the same issues. The Department of Environmental Resource Management for the City of Cape Town, South Africa (Case Study in Chapter 5) is also responsible and engaged in biodiversity conservation. Cape Town has such a high biodiversity that a
sustainable living guidebook for the city included a section for biodiversity along with energy, waste, and water. Both governments and nonprofits are well suited to delivering public goods. They can complement each other well. The mission-driven nature and private ownership of nonprofits means that nonprofits are able to address challenges that government is unable to do. Additionally, nonprofits play an influencing role and can encourage governments to behave in certain ways. Jax Bergersen’s involvement in a number of local government functions as head of Kuranda Conservation shows the ability of nonprofit organizations to complement government activities and conservation efforts.

Biodiversity has public benefits that are delivered indiscriminately to human populations. Biodiversity refers to the diversity of species, the diversity of genes within those species, and the diversity of local ecosystems where species reside. Approached from an environmental perspective, biodiversity is an ecosystem service. Often the value of biodiversity is undervalued and conservatively stated due to a “lack of information of the role, and value, of biodiversity” in providing ecosystem services (Daily, 366). Biodiversity is important for a number of reasons; that is why the Wet Tropics are so valuable. In TVA v Hill, 437 U.S. 153 (1978) the United States Supreme Court ruled that the value of endangered species was incalculable. Species provide many services. Modern pharmaceuticals are dependent on the large amount of diversity found in the jungles throughout the world. Species provide opportunities for new biotechnology and “the discovery of new drugs”; “hundreds of modern medications” exist today because they were developed from the wealth of species diversity on planet earth (Johnson). As biodiversity is threatened and species go extinct we are losing resources whose value we have no way of knowing today. Every species lost reduces the total gene pool available to
fight diseases or to adapt to climate change. The current loss of biodiversity, driven by
careless human development and the needs of a growing population, threatens very
valuable ecosystem services.

The habitat destruction and fragmentation that the Cassowary faces is emblematic
of the larger impacts of human development. Human domination of ecosystems has had
many negative effects on ecosystems (Vitousek, Mooney, Luchenco, Mellilo, in Adelson
et al., 367). Habitat loss caused by deforestation, economic and industrial development,
and human colonization threatens many unique species around the world. Extinctions are
extremely frequent. Already the current level of extinction events is so high that it can be
considered the Sixth Great Extinction. “Over the past 450 million years” there have been
six major extinctions, where “between 50 and 95 percent of these events” occurred during
the follow geologic periods: the Ordovician-Silurian, Late Devonian, Permian-Triassic,
Triassic-Jurassic, Cretaceous-Paleogene, and our current era called the Holocene (it has
recently be renamed the Anthropocene due to the scientific fact that humans are now
shaping the geologic history of the earth through climate change) (Johnson). Humans are
now causing an extinction event. Not only are species disappearing; they are disappearing
fast and because of us. The Sixth Great Extinction began when humans first started
spreading. While there are several theories as to the mechanism by which humans caused
extinction and what role the climate played and is playing in extinctions, the important
point is that global biodiversity is under extreme threat.

The current threat to biodiversity has global and local causes; it requires global
and local solutions. Climate change, a global problem, causes extinctions by altering
habitats. “Individuals of many species are rendered more vulnerable” and die out quickly
because they do not “adapt rapidly enough” (Johnson). Many species of this period of life live in specific climactic conditions that determine mating, range, and behavior. When these climactic conditions change rapidly, plants and animals are unable to adjust. The high biodiversity of the Amazon rainforest and the Australian Wet Tropics represent reserves of species; collections of living evolutionary history and providers of valuable ecological services that are threatened from their local climates changing due to larger global changes. The impacts of climate change are caused and felt globally. Actions to fight this major environmental challenge require concerted and complementary efforts from individuals, institutions, and governments from around the world. Kuranda Conservation focuses on the other cause of biodiversity loss – local disruption. Local activities, ranging from hunting to land use to conservation to planning laws, all affect local biodiversity. In order to prevent local destruction, targeted conservation measures are needed that recognize the value of biodiversity.

Kuranda Conservation is emblematic of how a nonprofit’s cause for existence, in this case preserving local biodiversity, is a major structural advantage when it comes to addressing environmental challenges. A nonprofit does not face the limitations that a business faces to deliver goods profitably. While financial stability is necessary, nonprofits are able to pursue specific goals that achieve public goods. When assessing what type of organization is best to address certain environmental problems, nonprofits are particularly attractive due to their ability to focus on, advocate for, and deliver on a specific mission or vision. Kuranda Conservation’s mission to preserve biodiversity guides their activities without consideration for profit or public opinion. Kuranda Conservation’s tactical focus also has its advantages; focusing on serving the charismatic
Cassowary uses effective conservation techniques. Not having a profit incentive allows for great flexibility to choose the best techniques or methods for conservation.

**Conclusion**

The nonprofit sector of society can bring tremendous value to societal environmental initiatives. The mission-driven organizational structure and style allows the sector to address issues with non-financial, but aesthetic, moral, or scientific value. This gives the nonprofit sector a particular advantage when it comes to changing the way the environment is valued. Nonprofits are able to use their private governance and mission to pursue environmental goals that have limited capturable benefit. The value of biodiversity is hard to quantify and even harder to capture. Businesses would find it extremely difficult or impossible to preserve these resources. Government, despite having a conservation mission, has competing interests and is ultimately responsible to its constituents. Nonprofits are able to protect biodiversity and similar environmental resources because of their mission-driven nature.
“All three of the wells are polluted. The farmer was weeping. He wanted to build his dam and now it is polluted by dying and bleaching units.”

– Dr. K. Sivasubramaniyan

Tanning leather is big business in India; symbolic of India’s economic and industrial rise, India’s tanneries provide leather for domestic and international markets. Tanning leather is a chemically intensive process that results in industrial waste. Despite India’s environmental laws and Supreme Court rulings, tanneries dump this untreated effluent straight into waterways and rivers. These are the same waterways and rivers that many of India’s population rely upon. The famous Ganges River is notable for its major degradation. Industrial pollution has damaged the river, perhaps irreparably. In Southern Tamil Nadu, tanneries have also contributed to water pollution by dumping untreated industrial waste into local waters. These polluted waters are relied upon locally for both drinking water and irrigation. Government officials are reluctant to require industry to treat their effluent because of the drive to “industrialization” and “economic growth.” An economic analysis conducted by the think tank Madras Institute of Development Studies (MIDS) found that the economic value from the new tanneries was equal to the economic value lost because of degraded agricultural land and reduced crop production. This is a classic externality. As surface waters were not safe to drink and because of increasing demand for water, ground water has increasingly been exploited by civil society. Ground water depletion is already occurring across Tamil Nadu and salt-water intrusion is
increasing. The paradigm that environmental protection comes at the cost of the economy is false; changing the way that we understand the true non-market values of environmental resources is integral to creating the new paradigm of joint ecological sustainability and economic prosperity.

The economic analysis performed by MIDS is illustrative of how academia works to address environmental market failures. Academic research institutions address environmental market failures in two manners. The first is by changing the way that individuals and organizations conceptualize and address environmental challenges. The second is by innovating and creating new technologies that reduce environmental impact and create new sources of value. The academic sector’s independence and potential for international collaboration allow the sector to create new technologies and to research new paradigms. Technological innovations enable other sectors to succeed in their environmental initiatives while social and natural science research fundamentally change the way in which we view environmental challenges.

The Role of Research Institutions

The academic sector includes research institutions. These institutions can be created by individual action or created by an organization from a different sector; the key trait separating these various institutions is independence. The research conducted from these institutions should have public benefit. Research activities focusing on technological innovation should use their findings to help either government or business pursue activities, which reduce environmental impact. Research activities focusing on changing our environmental paradigm must publish their results. This focus on a public benefit is what separates an Academia sector research institution from general research.
activities. In other words, a University Research Center would be considered part of academia while a business’ R&D division would not. The ultimate purpose of the research is what distinguishes academic sector institutions from other institutions. In order to be part of the academic sector, a research institution must have minimal interference in their activities and minimal limitations on what it publishes. This does not preclude government research institutions, which function as part of government agencies. While technically a government organization, these institutions retain the structural advantages of the academic sector. The two most notable advantages are independence and collaboration. Research institutions capitalize on these advantages to research new technologies and create new ways of understanding and addressing environmental challenges. These organizations are composed of subject matter experts: scientists, engineers, and social scientists. While research institutions can be classified as part of many different sectors, if they fit the above criteria they act in a distinct manner; organizationally they are best analyzed as members of the academic sector.

**Summation of Different Types of Environmental Research**

This section specifically investigates two types of environmentally themed research: technological research and social science research. Technological research has often been proposed, by free market advocates, as the solution to the problem of environmental market failures. While they are only part of the solution, new technologies present tremendous potential for social, economic, and political change. The internet is a good example. The introduction and integration of internet in countries across the world has increased access to knowledge and has had lasting, major consequences.
Environmental technologies address environmental market failures by creating alternatives that lessen overall environmental impact. Process innovation can lead to increased efficiency of production, reducing resource needs and costs. Technology has potential to solve many environmental challenges; low carbon energy sources like wind and solar power are strong alternatives to polluting fossil fuel plants. Improving technology and deployment is making these energy sources cost competitive due to economies of scale.

**MIDS**

The Madras Institute of Development Studies (MIDS) is a regional (or national) development think tank located in Chennai, India. Although almost exclusively funded by the government, the institution is independent in its activities and reports. During October 2011, I visited with Dr. K. Sivasubramaniyan and Dr. S. Janakarajan, faculty members of MIDS, and discussed a variety of sustainable development and water issues in Tamil Nadu, as well as the role that MIDS plays in supporting sustainable development throughout Tamil Nadu. Dr. K. Sivasubramaniyan is a water policy expert and assistant professor at MIDS. Dr. S. Janakarajan is a water and development policy expert and professor at MIDS. They focus on a variety of water, agriculture, environmental, and rural development issues.

Today, MIDS is a recognized social science research institution by the Government of India. MIDS is directed by a governance committee and academic committee, which ensure academic independence. The governance committee consists of
a “Chairperson, the Institute's Director as member-secretary, and representatives of
MIDS faculty, [Indian Council of Social Science Research], Tamil Nadu Government,
and from the Universities of the four Southern states, Trustees of the Institute, and co-
 opted social scientists” (About MIDS). Dr. Janakarajan is currently a faculty
representative. This diverse governance committee is complimented by an academic
committee. The Academic Committee has the Director as the chairperson and is

Objectives of the Madras Institute of Development Studies

- To undertake studies and research pertaining to development problems, with
  special reference to the agro-rural aspects of Tamil Nadu and the socially and
  economically backward sections of the population throughout the country.

- To conduct seminars and conferences on development issues concerning Tamil
  Nadu and the country at large.

- To foster inter-university co-operation among social scientists of the universities of
  the four southern states.

- To promote inter-disciplinary research, and disseminate information relating to the
  above activities.

- The research concerns of the faculty are wide ranging. MIDS has become a centre
  for critical thinking on development issues. The service of faculty members are
  sought by State and Central Government departments, autonomous agencies,
  universities and colleges, non-government and international organisations.

Reference: http://www.mids.ac.in/aboutus.htm
composed of external and internal Academic members. All professors at MIDS, including Dr. Sivasubramaniyan and Dr. Janakarajan, are on the Academic Council. This governance committee meets biannually to “review, and provide guidelines on, the academic activities of the Institute” (About MIDS). This dual Governance and Academic Council structure is designed to “ensure maximum autonomy” in the Institute’s activities and research (About MIDS). This autonomy is integral because it allows researchers to more accurately assess and analyze development issues, without political interference.

**Market Failure: Unregulated Water Pollution**

The lack of pollution costs has led to a market failure; the externalization of costs of production in the form of pollution has been so severe that it has a negative economic impact on other industries. Unlike climate change, where it is hard to estimate and assess the impact of global warming, the effect of these polluting activities is apparent. The cheapest way to make the product is by not paying for pollution controls, which is having a negative impact on water quality. Dr. Sivasubramaniyan told me a story about a farmer from Tamil Nadu he worked with in the 1990’s. The farmer fought for a small dam, a form of tank irrigation, to be built. This farmer hoped the dam would increase his agricultural productivity by allowing him to irrigate more often using the three wells on his property. The dam was built and the farmer was able to enjoy the benefits of irrigation for a year. The next year the farmer was unable to irrigate his fields because all three of his wells were polluted. Tannery pollution had affected him. “The pollution travelled twenty eight kilometers from the factories to that place,” said Dr. Sivasubramaniyan. “There are a lot of chemicals and other things that have polluted the groundwater.” Dr.
Sivasubramaniyan conducted a study of the economic impact of some tannery units throughout Tamil Nadu. He found that even though the tannery units created about 2,500 crores rupees (about $500 million) in economic activity they displaced the exact same amount in agricultural operations. MIDS’s research has identified this market failure. This is a unique tool of the academic sector: it is particularly powerful in identifying environmental market failures and challenges. By assessing the value of sustainable development this sector is able to inform and guide policy makers and businesses. This sector is unique in its ability to shape and develop environmental knowledge and understanding.

**Social Sciences and Environmental Knowledge**

Think tanks, like MIDS, use social science methods to generate and contribute to human environmental knowledge and understanding. The research process encourages a public, global discourse on environmental challenges. International collaboration happens in a number of sectors. The experts at MIDS get to experience many advantages of being in the academic sector. For one they have the ability to pick and research their own projects. The autonomous and independent nature of this think tank allows it to focus on its own select issues with government bureaucratic interference. They are also able to employ their skills in deploying different projects independently; Dr. Sivasubramaniyan mentioned working separately with an international NGO to study and implement tank irrigation methods. This allows for a more complete understanding and analysis of their study area of choice.
Conceptualization of Environmental Stewardship and Economy

Research that increases human knowledge has the potential to create new paradigms regarding the link between the environment and the economy. The above example shows how environmental protection can have economic benefit. The main challenge is that it is often not quantified and valued. Academia is important because it can reshape the terms of the debate between free market environmentalism and government involvement. Applying new forms of environmental knowledge will create new paradigms in understanding environmental problems. Ideally, the market failure could be corrected by a strong industry and government response. Government would issue regulations that cost pollution for their social cost while industry would respond by innovating to match or beat the standard. Academia plays a strong role in guiding other organizations in environmental management organizations. Shaping knowledge, regardless of the discipline, allows the Academia sector to act as an intersectoral collaborator. The research conducted by MIDS shows how environmental and economic health are not necessarily antagonistic; this action challenges the paradigm of economy versus environment and supports the paradigm of economy and environment.

C-WET

The Centre for Wind Energy Technology (C-WET) is an autonomous research and development institution of the government of India established in 1999 by the Indian Ministry of New and Renewable Energy (MNRE) in Chennai. The Ministry, recently founded, seeks to encourage the deployment of renewable energy. In order to do so it needs research capacities and support. MNRE founded C-WET in order to achieve its
goals “to tackle the challenges in sustaining the development and accelerating the pace of utilization of wind energy” across India (C-WET Website, “Background”). C-WET is an academia institution due to its autonomous nature and collaborative work; it conducts research to discover “innovations in development of components as well as sub-systems of wind turbines in association with other R & D Institutions and Industry” (C-WET Website, “Research & Development”). C-WET is governed by a Governing Council that has twelve members who act as the policy making body for the institution. The Secretary of the MNRE is the ex-officio Chairman of the Governing Council. An Executive Director head C-WET and directs research activities. The current director is Dr. S. Gomathinayagam. I met with Dr. Gomathinayagam in mid October 2011 and asked him some questions about C-WET and its operations.

Currently C-WET has 14 researchers in a variety of disciplines. These areas include Research & Development, Wind Resource Assessment, Wind Turbine Testing, Standards & Certification, and Information, Training & Commercial Services. There is also a group dedicated to Solar Radiation Resource Assessment. Together these different groups enable C-WET to address a variety of technological development needs. For example, one of the institution’s current projects is focused on testing an offshore wind turbine.
The Centre for Wind Energy Technology is an attempt to increase the competitiveness of Indian wind. Major challenges remain. According to Dr. Gomathinayagam, 95% of wind India’s wind energy financing comes from private investment. India is unable to provide the same level of subsidies that other major economies, such as China, the US, and the EU provide to their local industry. Nevertheless, India has some power in the domestic wind front. Some of that advantage comes from C-WET and their research programs. C-WET operates the only wind technology testing facility in Asia in Kayathar, several hundred miles south of Chennai. This center is operated “with technical and partial financial support” by Danida, the Danish
International Development Agency (C-WET Website, “Background). Suzlon is the largest Indian wind company.

**Technology Development**

C-WET has many different projects and programs dedicated to technology assessment, guidelines, and other research activities. These activities contribute to advancing wind energy in India. One key project shows how the international collaboration that academia brings supports development objectives; the creation of the India Wind Atlas resulted from the “combined effort of Centre for Wind Energy Technology (CWET) … and Risø DTU National Laborotary for Sustainable Energy from Denmark” (An Informative Flier). The Indian Wind Atlas was created to assess India’s wind resources harvestable with current technology. Such information can be valuable to governments and businesses looking to develop wind power in India. The Atlas can be used “in all three stages of wind resource assessment” (An Informative Flier). Governments and business can use the wind energy projections to begin identifying potential sites for new wind farms. After they have identified the sites they can then send in meteorological measuring units to calculate the actual wind resource available. The National Renewable Energy Laboratory (NREL) has conducted a similar resource assessment of the energy available in the US. (Those assessments are available at this website: [http://www.nrel.gov/gis/wind.html](http://www.nrel.gov/gis/wind.html).) This kind of resource assessment can help states recognize their renewable energy potential. It catalyzes development. Importantly, resources like these can be used by local entrepreneurs and multinational corporations to assess the economic feasibility of wind energy in certain locations. This kind of resource
offers a powerful tool that helps guide other sector’s environmental activities. Combined with C-WET’s other technological activities, this tool could serve as a foundation for a robust domestic wind energy market. This market would likely include international corporations; Vestas already has significant operations, including a research center, throughout India.

Tech Transfer Challenges and the Importance to the Domestic Economy

National capabilities to react to climate change depend on available technologies. Developing countries like India are disadvantaged when it comes to using technology to reduce carbon emissions because of a lack of technological development. Technology transfer can be “critical to consistent progress toward sustainable development” (Callan and Thomas, 494). In order to increase economic growth and standards of living, countries have to develop. This leads to a general increase in their energy consumption. Often developing countries follow the fossil fuel western model of centralized electricity development. Coal is a powerful energy source that still powers much of India’s electricity grid. Unless India actually has the technology to create energy without producing carbon, India will be unable to meet environmental goals while still fighting poverty. Unfortunately, despite many promises to the contrary, India has not benefit from new, clean energy technologies. Hence CWET was created to overcome the technology transfer barrier by recreating technologies. The motivations of the countries with such advanced technologies are clear; they are trying to maintain a technological and market advantage.
The difficulty in transferring technology across countries presents other challenges in reducing externalities. Competitive interests have made technology a resource. This makes technology transfer into an issue of power and money. Despite the fact that the benefits of reducing carbon emissions are felt globally, some countries do not have the technology or access to technology. This means that even though there are solutions to environmental challenges, the competitive nature of the market prevents their widespread diffusion. Multiple barriers to diffusion exist. “Large multinational” businesses are often criticized for “limiting effective technology transfer into local foreign economies;” indeed these businesses act as “barriers to the international transfer of technologies” (Brewer and Mani, 104). CWET researches some technologies that other nations already have. Instead of focusing on deploying wind energy or refining the technology to make it even better, this organization is forced to build from the ground up. While Brewer and Mani noted that technology transfer can occur from the global south to the global north, most often technologies are held by individuals within first world nations (93-96). C-WET’s work to research an offshore wind turbine is duplicating technology already perfected elsewhere. Some technology transfer is prevented due to policies concerning trade. Specifically, for the “wind energy industry,” common barriers include “tariffs,” “barriers to trade in services and FDI” (Brewer and Mani, 106). These barriers, while not insurmountable, are preventing a universal diffusion of wind energy technologies.
Limitation: Diagnostic, limited actual power

A major challenge for MIDS analytical work is implementation. Dr. Janakarajan noted India’s challenge is not so much water scarcity as poor management. India’s inability to enforce pollution control laws has an adverse affect on civil society and business management of all water resources. As industrial operations have no real incentive to reduce their pollution, they are able to externalize the cost of pollution to civil society. In response to worsening resources, water consumption patterns have changed to increase fossil water consumption. Fossil water is a nonrenewable water resource. Already wells are starting to run dry and the effects are being felt. Despite analysis from MIDS, the push for economic growth has driven the emergence of the tannery industries. Local officials are often hesitant about shutting down industries that they see as important to economic growth. This is emblematic of the “race to bottom” phenomenon; developing countries that are competing for manufacturing will often try to make production as cheap as possible through the externalization of costs. These overall do not have a positive growth due to the negative effects on local agriculture and populations. This is the major limitation of many Academia activities. Despite their analytical approach and research they do not control implementation of laws.

The organizational effectiveness of environmental research organizations often depends on the strength of their partners, especially government. India is a developing country that has limited ability to enact policies. Policies that are passed are hard to enforce. According to Dr. Janakarajan it takes a while for initiatives to pass down from the national to the state to the village level. Even with top government level support it is difficult to implement policy recommendations. If MIDS or C-WET found a new policy
or developed a new technology it could be difficult to implement. Water quality is the perfect example. The Indian Supreme Court ruled that waste effluent from tanneries in Tamil Nadu had to be treated in 2009. Despite that ruling, dumping continues. Many believe the tanneries contribute to economic growth and poverty alleviation. Importantly the tanneries bring foreign exchange. “Even the pollution control police,” said Dr. Sivasubramaniyan, “are not so strict because money is important.” Foreign exchange is considered more important than pollution control. The effects of the pollution are aesthetically noticeable. When I travelled through Chennai I identified rivers by smell, not sight. The rivers around Chennai smell horrible due to the high levels of pollution. The stench, evidence of pollution, is so severe that I was happy to get a blast of diesel exhaust to clear my lungs while riding across a bridge.

Research institutions have a major advantage when it comes to finances. Academia’s activities, while constricted by available resources, do not need to have financial viability. The value of research is hard to quantify; funding often comes from external sources that do not seek a return on investment. This gives academia freedom in the scope of its activities. Research institutions do not face competitive pressure to deliver profit. In fact, considering the scale of research activities, funding invested often has non-quantifiable large-scale benefits. MIDS identifying the economic losses from a lack of pollution control allows changes to be made that will have large reaching effects. The study on pollution control showed that tanneries had no net economic benefit due to agricultural displacement from pollution, a negative externality. Policy makers are able to realize substantial economic benefit by recognizing the potential benefits of pollution controls that maintain industry production while restoring agricultural productivity. The
funding provided towards MIDS activities helps define and quantify environmental challenges, allowing for more informed decision-making. The return on research investment can be large. The same is true for C-WET’s activities. Their research on wind energy technology has substantial benefit by enabling companies to enter and exploit the domestic Indian wind energy market. This type of research, combined with collaboration from international partners reduces costs across the market, making investment and deployment of renewable energy technologies more cost effective and rapid. Companies do not have to conduct the same work that C-WET does and can rely upon the resources it produces. While not a direct subsidy, the benefits of funding research catalyze wind energy development.

**Conclusion: A New Environmental Paradigm**

The Indian Government’s decision to found and support autonomous research institutions like MIDS and C-WET is a good policy decision. These organizations are able to use high-level research activities to diagnose environmental challenges and develop a new and strong domestic wind industry. These institutions bring some of the benefits of the academic sector to environmental management in India. International collaboration is a powerful tool to create and develop technologies and resources, which can catalyze sustainable economic growth. Without international collaboration, India’s research institutions would not be as effective in supporting environmental management activities.

The activities of research institutions are leading to a world where environmental value is truly recognized. Technological innovation poses great promise for
transformative change due to the potential to reduce negative environmental impacts. CWET’s research to further wind energy technology – a technology which avoids producing the externalities and carbon pollution that India’s current electrical system does – offers serious potential to catalyze the creation of a strong domestic wind industry. By creating new technologies CWET enables other sectors to address market failures using their respective advantages. In other words, by designing new technologies, CWET helps the Indian government and Indian domestic businesses deploy wind energy. MIDS’ research is challenging the conventional wisdom. They are working to change the way we view the environment: it is a partner, not a trash dump.
“Local government in South Africa does not have a mandate for environmental management.” – Osman Asmal, Executive Director of the Environmental Resource Management Department of the City of Cape Town.

Introduction

Cape Town is a city of great environmental heritage. The region is home to the Cape Floristic Kingdom, the smallest of the world’s six floral kingdoms. The city is a biodiversity hotspot that faces challenges today from population growth and development. These modern day challenges are overshadowed by the long-term threat of climate change. In order to promote environmental sustainability, the City of Cape Town established the Environmental Resources Management (ERM) Department. Today this department partners with organizations and individuals across sectors to deliver environmental results. While ERM has many different responsibilities, a few stand out. Its education activities encourage and enable civil society to organically address environmental challenges. The department works with other departments throughout Cape Town’s government to encourage the adoption of environmental practices. ERM handles and coordinates the city’s response to climate change and is
actively planning for and adopting adaptation strategies. The department also addresses environmental valuation failures specifically through its attempts to quantify the benefits of ecosystems services. **Despite local government having no mandate for environmental management, the ERM Department of the City of Cape Town has been effective in advocating for and delivering environmental management to preserve the city’s unique and valuable natural resources.**

ERM

In late September 2011, I sat down for tea and a research interview. I met with several members of ERM’s staff including Osman Asmal, Executive Director of ERM, Lindie Buirski, Head of Environmental Capacity Building, Training and Education at ERM, and Penny Price, Urban Environmental Management Plan Co-ordinator. We discussed ERM’s roles, responsibilities, results, and challenges. “Local government in South Africa does not have a mandate for environmental management,” according to Asmal. In practice this means that local government is not responsible for addressing environmental concerns. This has shaped ERM’s activities and redefined its role. It often has to make the case for environmental sustainability to other departments within city government.

The Environmental Resource Management (ERM) Department of the City of Cape Town is a local government agency tasked with implementing the city’s environmental policy. That policy is the Integrated Metropolitan Environmental Policy (IMEP) which outlines a number of “strategies and programmes for environmental sustainability” across Cape Town (“Environmental Resource Management”). In order to
implement this policy, ERM works on a wide variety of tasks, including both operational and strategic issues and initiatives. ERM has a permanent staff of over two hundred. Functional areas include biodiversity management, heritage management, environmental capacity building, environmental strategy and partnerships, resource conservation. ERM’s budget has grown over the last budget cycle. For the three-year period from 2006 to 2009, Asmal indicated the department had an operating budget of 210 million rand (about $26.5 million). Of that amount, around 75% of that (150 million rand) was from external sources. For the upcoming three-year period Asmal said the operating budget is 360 million rand (about $45.6 million) guaranteed, with approximately 130 million coming from external sources. This increase in budget is reflective of ERM’s increasing role in helping the City of Cape Town become more environmentally aware.

**Integrated Metropolitan Environmental Policy**

The City of Cape Town’s Integrated Metropolitan Environmental Policy (IMEP) establishes the city’s goals and environment vision through 2020. The policy recognizes that the City’s “greatest assets are its people and natural environmental beauty and resources;” the environment is considered the City’s “unique economic asset” (“Integrated Metropolitan Environmental Policy,” 4). This is not an overstatement. Millions of people visit Cape Town every year, largely to enjoy its natural beauty, which includes Table Mountain, white sharks, seal colonies, and a unique floral kingdom. IMEP is meant to be a “statement of intent” and “a commitment to certain principles,” which will guide the city’s activities to “ensure sustainable resource use and management” (“Integrated Metropolitan Environmental Policy,” 4). Published in 2003, the IMEP policy
contains a Leadership Pledge to the policies and principles outlined in the policy. Town Councilors and senior management are to sign this pledge. IMEP contains long-term goals, tools, and specific sectoral commitments. The long term goals include such things as “a positive relationship between local government and civil society, collective responsibility for the environment,” a population that is environmentally educated, improved environmental quality, heritage protection, elimination of environmental poverty, improved waste management, expanded public transport, and maintenance of open spaces for the protection of biodiversity (“Integrated Metropolitan Environmental Policy,” 5). These goals are not just sustainability focused. Rather, they incorporate social equity goals to improve the general welfare of Cape Town’s citizens while protecting the environment. IMEP contains a commitment to the principles of sustainable development – environmental actions are not just about preservation but also include assisting impoverished communities. This is critical in a place like South Africa, which has some of the highest levels of inequality in the world.

The implementation of IMEP is to happen at the highest levels of government and provides a framework for other sustainability strategies. The tools of IMEP include the use of environmental monitoring, cost-benefit analysis, environmental risk management, guidelines, research, public reporting, and environmental education. The city has a number of other environmental strategies and goals. A prominent one is the city’s Energy and Climate Change Strategy. “My first experiences with climate change started about 14 to 15 years ago,” according to Asmal. “We only got it to the mainstream in 2005 or 2006.” The city’s Energy and Climate Change Strategy aims to guide specific actions in
response to climate change activities. ERM is responsible for coordinating many aspects of Cape Town’s environmental policies.

**Roles and Responsibilities**

Due to the large scope and scale of Cape Town’s environmental policies, ERM is responsible for a large number of tasks. Examples of these responsibilities include environmental education, climate change, and quantifying ecosystem services.

Environmental education is a key part of the City’s environmental policy. The City’s environmental assets are to be enjoyed and protected by all of the city’s inhabitants and visitors. In order to promote and increase understanding of sustainability, ERM has several environmental education programs. These programs enable civil society to understand and address their environmental impacts. Climate change mitigation and adaptation are key issues for the City. Already the City has begun identifying the potential impacts of climate change. They are preparing to deal with the negative costs from fossil fuel burning. This adaptation work includes the use of an innovative think tank that brings together Academia and topic experts to identify risks from future change. Additionally, ecosystem services provide many free benefits to the city. In order to encourage the protection of these valuable assets, ERM researched and presented an in-depth report of the value these services bring. By quantifying the value of ecosystem services, ERM hopes to guide city government in properly valuing the environment.
Environmental Education

One large ERM task is environmental education. Many of the goals in IMEP require education of general populace to be engaged and aware of environmental issues. This work has the effect of influencing and changing behavior within civil society. By educating community members, ERM enables local society to consciously change their environmental behaviors. In practice, this environmental education manifests itself in a number of different activities. Youth are especially targeted for engaged environmental education. “We just had a program that took kids from really poor areas and took them to the coast,” according to Buirski. These youth had never actually been to the coast. “They can’t respect and care if they have never been exposed for it,” said Buirski. “If you don’t take them there they will never make the connection that ‘what I do has an impact.’” Exposing youth to Cape Town’s assets has potential long-term benefits. These children are the future of the city and their actions will determine its environmental future. This type of exposure and education is critical; only by knowing and being familiar with Cape Town’s natural resources will individuals within civil society change their behavior. Education and exposure is critical to enabling civil society to play its role in reducing its

<table>
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<tr>
<th>Household Type</th>
<th>kg CO₂/month</th>
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<tbody>
<tr>
<td>Low-income non-electrified home in Cape Town</td>
<td>146</td>
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<tr>
<td>Low-income electrified home in Cape Town</td>
<td>193</td>
</tr>
<tr>
<td>Mid-income home in Cape Town</td>
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Source: Smart Living Handbook, Page 70
environmental impact. ERM has also produced a number of publications designed to guide and inform the citizens of Cape Town in how to adopt sustainability. These publications include The Smart Living Handbook and *Enviroworks*, the biannual environmental newsletter of the City of Cape Town. Combining direct exposure with these educational resources informs members of civil society about the value of the environment.

The Smart Living Handbook was developed to inform local citizens about how they impact the local environment and how to reduce that impact. The handbook emerged from several of the many partnerships that ERM has: “the Smart Living Handbook was developed on behalf of the City of Cape Town by AMATHEMBA Environmental Management Consulting and Sustainable Energy Africa” (Handbook, i). The handbook includes four general sections: energy, water, waste, and biodiversity. It provides many different resources and tips within each section. The overall goal of the handbook is to help guide households, regardless of socioeconomic status, in reducing their environmental impact. It enables civil society to voluntarily take action to help protect the City of Cape Town’s environment. Resources within the handbook include descriptions of environmental challenges, energy sources, worksheets, and recommendations. Using the book can effectively help a citizen estimate and reduce their environmental impact. For example, there is a worksheet that allows users to estimate their household carbon footprint (see below). The worksheet contains sections that are filled in by looking at personal utility bills and consumption of electricity, LP gas, and paraffin. Users can then compare their household carbon footprint to similar types of houses throughout Cape
Town. By creating the Smart Living Handbook, ERM is increasing the capacity of individuals within civil society to address environmental challenges on their own.

**Quantifying Ecosystem Services**

Cape Town’s rich environmental resources provide ecosystems services that provide significant benefit to the city’s operations. Ecosystem services, as discussed in Chapter 1, are services provided by the natural environment for free. Examples are things such as clean air or water purification. The benefits of biodiversity would also be an ecosystem service. These services are often not valued or accounted for. “What we have done over a period of a few years is look at our ecosystem services,” according to Buirski. “We have tried to quantify and look at what the financial value of those services are.” Quantifying the value of ecosystem services allows city planners and policy makers to understand the true economic impacts of their activities. In order to improve the City’s capacity to account for and invest in natural capital, ERM produced a report titled “Investing in Natural Assets” that explored the financial benefits from various ecosystem services. This report notes the “services provided” to the city by its “ecological assets” is “substantial” and argues that investment in natural assets is an “economically rational decision” for Cape Town ("Why Investing," 1-2). Precisely quantifying ecosystem services can be difficult. Given that consideration, ERM specifically notes that its estimate is conservative as “not all goods and services” provide by nature “could be measured” in the study ("Why Investing," 5). Nonetheless, the financial benefits that ERM identified are important in determining the real value of Cape Town’s environment and the services ecosystems provide locally. ERM estimated that the “annual flow of
goods and services from natural assets” to be approximately 4 billion rand (about $500 million) while the total value of natural assets is estimated between 43 billion rand and 81 billion rand (between $5 billion and $10 billion) (“Why Investing,” 5). Notably, the report also determined that local government investment in promoting and protecting its environmental resources had a higher leverage value than other investments. What this means is that for every dollar spent by municipal government, ecosystem assets had higher returns than other activities, between 1.2 and 2 times larger (“Why Investing,” 6). Additionally, preserving these services reduces the need for costlier physical infrastructure projects. Ecosystem services are both a strong asset and tool for local governments. Properly valuing these services yields tremendous benefits.

Methods

ERM uses many different methods to drive the City’s environmental policies. Two are of particular note: the hub and spokes model and the use of partnerships and collaboration. The hub and spokes model is a model to coordinate environmental activities and initiatives throughout city government. It enables organizational environmental champions to internally promote sustainability. Partnerships and collaboration are very powerful tools that increase the capacity of ERM to deliver on its goals. These two strategies enable local government to address the sustainable development imperative.
**Hub and Spokes Model**

ERM pursues its sustainability mandate through the use of a hub and spoke model. In this model there is direction and strategic planning by a central hub. The spokes operate in their respective areas. While centrally directed, this method allows for internal environmental advocacy, instead of external imposition. ERM has used this strategy effectively to empower individuals within other departments of the City of Cape Town to promote sustainability. “Often people are supportive of the issues but they don’t have the resources, the time, or the coordination,” according to Asmal. “It is about getting somebody to lead that process.” ERM acts as the central hub in coordinating the city’s environmental activities. The spokes are people within other departments who internally promote sustainability. These individuals often have to prove the benefits of going green. “The electricity department has seen the benefit of and has a permanent high level position for someone that works with us,” said Asmal. The transport department required a longer approach; ERM used external funding to fund a full time position within transport for a three-year funding cycle. Previously the department did not have the resources or time. The individual worked as an environmental champion and advocated for sustainability. They brought significant value added through their approach. This trial demonstrated the value of sustainability for transport and they were able to allocate funds for the next cycle. Coordinating and empowering these individuals within other organizations has a multiplier effect on the capabilities of ERM to promote the City’s green policies.
Partnerships and Collaborations

ERM makes extensive use of partnerships and collaboration to achieve its goals. “The majority of our work is done through external partnerships,” said Asmal. “We would not get work done without them.” In fact, ERM works with over 120 external partners from across many different sectors. Part of this is due to the limited resources and power of the ERM department. “We have to be consultative,” said Asmal, “build relations.” As noted earlier, when dealing with other departments within the City of Cape Town, ERM has to approach them with project ideas or funding requests. ERM has to convince other departments of the benefits from sustainability. Beyond that ERM coordinates and works with a number of organizations to promote sustainability across the city.

Limitations

One challenge for governmental environmental activities is political change. In democracies, power often shifts between different parties and candidates. Changing leadership at the City of Cape Town is a challenge that ERM must overcome. A lack of political party stability increases the difficulty of effective environmental management. According to Asmal, it is not a matter of partisan politics, but stability. “When we have not had political stability we have struggled to get things done.” This is due to the challenges of interacting with and informing a changing government. “Every time that we have a new election we have to inform the new council about our work,” said Buirski. “It takes time.” Politics can often pose major barriers to government implementing environmental programs.
Local government can face similar challenges to businesses in ensuring financial viability. “We are seeing that unless it makes a business case people are not going to invest,” said Asmal. “They are not going to invest for a moral reason.” Luckily, as shown in Chapter 2 with Backsberg Estate Cellars, resource efficiency makes business sense. Reducing costs through using things more efficiently has benefits. However, environmental initiatives with hard to recognize benefits, such as biodiversity protection, do not fall under this logic. This shows the importance of quantifying ecosystem services – without proper quantification, it is hard to determine the financial value of environmental services. Without a value, it is hard to argue for protection. ERM is responsible for managing many local parks that preserve biodiversity. This is fortunate as it means that ERM is directly managing a resource with a hard to quantify value. Direct management reduces the challenges of having to convince other departments of the importance.

Conclusion

The ERM department at the City of Cape Town has been successful in encouraging the implementation of sustainability throughout the city. Leveraging the hub and spokes model and intersectoral partnerships has enabled the department to do much more than its own resources allow. Internal advocacy within other governmental departments has reshaped perceptions of sustainability throughout the city while allowing ERM to have a larger impact through coordination instead of direct management and intervention.
ERM’s activities address a number of environmental valuation challenges. Climate change is caused by negative externalities from fossil fuel burning. The City of Cape Town’s work preparing for climate change adaptation is one way of addressing externalities. In essence, adaptation work is the cost that is externalized through atmospheric pollution. This work is dealing with the problem after the fact, and resources spent for adaptation ought to be counted in the actual cost of energy production. Further, ERM’s work to quantify ecosystem services to guide sustainable development in Cape Town is an attempt to ensure that public policy is guided by a true understanding of the costs and benefits of development activities.

“The one great thing about the department is that we have a bunch of very passionate people. That’s the general sense of people working in the environmental sector, a bunch of very passionate people.” – Asmal on why ERM has been successful in a number of environmental endeavors.
Different types of organizations are better able to address different challenges to sustainability than other organizations. The preceding chapters provided a brief survey of institutions across different sectors of society and the role that they play in addressing environmental challenges. These challenges stem from problems in adequately accounting for the value of the environment. Each of the case studies presents different valuation concepts and organizational responses to them.

The civil society of the Berbers of the High Atlas Mountains developed the Agdal institution in order to address governance challenges of common pastureland. This institution is ineffective due to population growth and the exploitation of non-governed commons land. Increasing population is forcing Berbers to use marginal land and degrade commons resources. As every individual has an incentive to use this land as much as possible, severe land degradation has led to erosion. This exploitation damages local ecosystem services. Intact hillsides are needed to retain and regulate water flow. Despite being a water-dependent society, the Berbers have not reacted to the threat of losing ecosystem services. Government intervention occurred due to the far-reaching impacts of land degradation. This degradation has affects water supply throughout Morocco. The national government is encouraging the replanting of trees to help reduce erosion and retain soils. This may or may not be effective. Rather, this case study illustrates that institutions within a sector of society may not be well adapted to addressing environmental challenges; sometimes organizations from other sectors of society are needed to address different challenges.
Backsberg Winery worked to internalize all social and environmental costs of production, adapting the ISO 14001 management system to guide them in reducing the environmental damage from wine production profitably. Backsberg illustrates how dedicated management activities can reduce environmental impact depending on the strengths of the specific organization. As a business, Backsberg is particularly adept at using resource efficiency to reduce costs. Changing practices and implementing new technologies unlocks the value of efficiency. By embracing sustainability and paying for carbon offsets, owner Michael Back is internalizing previously externalized costs of production, such as carbon emissions. This creates a monetary incentive to reduce energy and resource consumption. As a business, Backsberg is well suited to adapt to this monetary incentive. In addition to financial benefits, Backsberg enjoys an improved reputation from its activities. This reputation and recognition distinguish Backsberg from competitors while also giving Backsberg competitive advantages.

Kuranda Conservation Community Nursery preserves an invaluable resource, biodiversity, through conservation activities. While Backsberg also preserves biodiversity through voluntary action, Kuranda Conservation’s nonprofit structure gives it a unique ability to address biodiversity challenges. The value of biodiversity is hard to quantify and almost impossible to capture. We have no idea what potential value diversity brings to us; for all we know our rich biodiversity will provide solutions to challenges we cannot even address yet. The problem is how to capture that value. Businesses exist to sell a good or service. They need a monetary incentive to operate. Biodiversity does not yield immediate results for conservation but has long term potential. In today’s paradigm of economic growth and development the incalculable long-term benefits of preservation are
superseded by short-term interests for profit. Kuranda Conservation’s mission-driven structure means that it can use many different techniques to achieve its goals without regard to trying to make a profit. It does not exist to sell something, but rather to achieve a goal. While this lack of focus on financial success can present resource challenges it gives Kuranda Conservation tremendous freedom in the scope of activities it undertakes. This freedom allows Kuranda Conservation to use ecological principles and methods for preservation. Unlike governments, which are also able to address biodiversity, nonprofits’ independence means they will always pursue their mission or goal. They do not have competing priorities and do not have a responsibility to react to people’s demands. Kuranda Conservation’s mission and independence allows it to be a strong advocate for a resource that is difficult to value.

The Madras Institute for Development Studies and the Centre for Wind Energy Technology demonstrates how independent Academia institutions are able to define and address environmental challenges. Research at MIDS shows how prioritizing economic growth over environmental health is a false choice. Pollution controls offer a strong regulatory option to reduce environmental damage while also maintaining economic growth. The environment is intertwined with our economy very closely. Negative externalities, such as pollution, can have far reaching effects on different economic activities. By dumping untreated industrial effluent into waterways, tanneries can displace the same amount of economic activity as they create. This example clearly shows that economic and environmental health can be linked. By identifying that connection, MIDS exemplifies the underlying principle driving environmental management activities across sectors: the principle of proper valuation and management
of environmental resources. This principle has the potential to change the human relationship with the natural environment from one of exploitation to one of stewardship. C-WET enables organizations to realize this principle through technological innovation. The technologies that it is researching internalize all costs of energy production. By developing wind energy technologies, C-WET is laying the technological groundwork for a thriving Indian wind industry. Wind energy has minimal environmental impacts compared to the negative externalities associated with coal and fossil fuel use. Research institutions use international collaboration to further their effectiveness, allowing for global action on sustainability.

The Environmental Resources Management Department of the City of Cape Town addresses a number of environmental challenges through partnerships, advocacy, and strategy. ERM has been successful in encouraging other departments in city government to adopt sustainability practice through the use of organizational environmental champions. By using a hubs and spokes model, ERM can coordinate the city’s overall sustainability strategy. ERM’s efforts have allowed the city to tackle a number of valuation problems.

Each sector has different advantages and limitations that shape their institution’s ability to enhance sustainability; partnerships combine these advantages to allow for maximum benefit. Nonprofits, academia, and governments are especially able to take advantage of the benefits of partnering with other organizations. Sometimes many institutional goals and activities rely upon partnerships within and across sectors. Kuranda Conservation Community Nursery does many activities to help protect biodiversity and the Southern Cassowary. However it cannot accomplish this task on its
own. By working with partners, including many community members, Kuranda Conservation is able to coordinate its conservation actions for maximum effect. The Tablelands Regional Council Pest Management Advisory Committee illustrates the benefits of partnerships. This government committee combines representatives from many different stakeholders to combat invasive species. Both MIDS and C-WET have active partnerships with developed world based Academia locations which increase their capacity to achieve their goals. For MIDS it is social science research and collaboration. At C-WET, partnering with DANIDA to create the Indian Wind Energy Atlas allowed C-WET succeeding in its mission in supporting the Indian wind energy market. The ERM Department of the City of Cape Town relies on partners for many of its activities. Within city government it works to encourage other government departments to embrace sustainability internally as this is much more successful than an external mandate. ERM, due to the size and scope of its activities, collaborates with all sectors to achieve its mission. Collaboration across sectors and nations combines the capabilities of different organizations to achieve more successful environmental management.

The results of this thesis and survey suggest that additional work can be done in investigating cross sectoral alliances and strategy when it comes to environmental problems. Arya and Salk note that increased collaboration between for profit and nonprofit organizations increases for profit’s capability to adapt corporate social responsibility initiatives; specifically “cross sectoral alliances… can provide greater incentives to be socially responsible” and they increase firm’s capacity to align “social responsibility with economic performance” (211). Kuranda Conservation’s work with the Tablelands Regional Council shows how different organizations are working together to
tackle biodiversity challenges. Research by Curtin found that similar collaborations between “ranchers, conservationists, and researchers” near the US-Mexico border was successful in allowing organizations to achieve “scientific and conservation goals unobtainable by any one group alone” (880). Future research into cross sectoral collaboration could identify future opportunities for using complementary comparative advantages to ensure environmental and economic well being.

Sustainability is as much about long-term success and human survival as it is about environmental preservation. Degradation of natural resources caused by improper management and valuation threaten the foundations of our economy. A malfunctioning climate will disrupt water availability, crop production, among many others. A growing human population only promises to increase the strain on our current modes of production. The current environmental economic paradigm has already pushed the earth passed its ecological limits due to overconsumption and population growth. Our environmental life support system cannot handle the increasing number of humans or the increasing affluence as developing countries follow the western model of economic growth.

Globally, comparative institutional structural advantages of actors within a specific sector of society (business, nonprofit, government, academia, and civil society) determine their capability to conceptualize and implement environmental innovations, initiatives, and paradigms to environmental valuation challenges.
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Image Citations

Figure 1. Map of Morocco. http://www.world-guides.com/images/morocco/morocco_map.jpg

Figure 3. Indigenous Crops:

    Cactus: http://3.bp.blogspot.com/-RSqZGmQSzW4/TqhGClVzvl/AAAAAAAAHaA/uzSRVdFv2RE/s1600/Cactus.JPG

    Olives: http://3.bp.blogspot.com/_GznvopMePe0/SszWjLg4yUI/AAAAAAAAA-s/etWctwg0R0g/s400/La-Picholine-copie-1.jpg


Figure 4. Introduced Crops

    Pumpkin: http://connemaracroft.blogspot.com/2010_07_01_archive.html
    Mint: http://travelmemoir.files.wordpress.com/2010/10/dsc05804.jpg
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Figure 5. Map of South Africa and Stellenbosch.

Figure 8. http://www.conservation.org/where/priority_areas/hotspots/africa/Cape-Floristic-Region/Pages/default.aspx

Figure 10. City of Cape Town Logo.

All other Images were taken by the Author or his friend, Johnny Snelgrove.