Silent Spring's Metaphors
Insights for
21st Century Environmental Discourse

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Thesis submitted to the faculty of the Virginia Polytechnic Institute and State University
in partial fulfillment of the requirements for the degree of

Master of Science
In

Science and Technology in Society

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December 10, 2004
Blacksburg, Virginia

Keywords: Rachel Carson, *Silent Spring*, Metaphor, Paradigm, Environmental Discourse

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ABSTRACT

Metaphor as tool is a concept that has increasing analysis and support in the past several years. Long before the wealth of contemporary analysis, Rachel Carson produced *Silent Spring*, a book hailed as the motivation for a new environmental movement in the United States. The use of metaphor in *Silent Spring* is most apparent in the title. The title's focus, however poignant, even moving and motivating, is complemented by a rich set of metaphorical entailments and implications that reinforce and strengthen the title's metaphor and represent systemic forces and practices that lead to and prevent a spring of silence. Carson skillfully appropriated marketing metaphors used by chemical companies to sell insecticides and pesticides. She transformed these metaphors into powerful criticisms of indiscriminate chemical practices, forcefully undercutting industry arguments for chemicals as a means of guaranteeing "control." The effects of Carson's metaphors, built on a strong, complex foundation of scientific studies, invite reader participation and interaction as outlined by Lakoff and Johnson. The metaphors further entertain, educate, explain, describe in the sense of Wittgenstein's language games, and tightly integrate action and language. More fundamentally, her metaphors helped to establish a systems view and nature-oriented paradigm for analyzing, and resolving environmental issues and problems in the United States, creating a framework for debate and policy development and implementation, in the vein of Schon's and Rein's arguments for framing and policy design. The metaphors also set a stage for personal motivation by connecting individual human homes to nature and the global environment.

Author's Acknowledgements

The inspiration and motivation for this work came to me from a number of kind and patient people who gave me the latitude for free association and the disciplined guidance to focus on the possible. Barbara Reeves first showed me how metaphor was so fundamental to science, technology, and living. She never tired of offering support and new insights and sources. Scott Hauger was similarly forceful in expanding my boundaries, pushing me beyond my simple views of paradigms and my fears and incomprehension of Wittgenstein. Their suggestions and recommendations were the tools and perspectives that were the flesh that found a home on the bones provided by Barbara Allen whose excitement for risk analysis and environmental passion moved me to reorient my approach to this thesis and helped me rediscover Rachel Carson, seeing her with new eyes and potential. Eileen Crist's gentle probing and corrections, combined with her fierce compassion for nature and wilderness and deep respect for Carson's literary and scientific skills, brought me a sense of humility and spirituality that abided during my research and writing. I owe a special debt of gratitude to my loving wife, Maureen Doallas, who supported me throughout the process with care and nudging, never complained about the growing and disheveled piles of papers and books in our dining room, and who continually provided me with insights about the ways that Carson's legacy is living in today's polarized environmental debates.

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Chapter One: Introduction:

Background

Readers in the early years of the 21st century have seen an increase in policy pronouncements about environmental issues, reports, and proposed agreements dealing with global climate change. The Kyoto Protocol, for example, was a focal point for environmental discourse before the September 11, 2001 attacks in the United States and subsequent wars in Afghanistan and Iraq. The Protocol is an un-ratified international agreement intended to reduce emissions caused by the burning of fossil-based fuels. The agreement will enter into force when 55 or more countries, including countries that accounted in total for at least 55 % of the total carbon dioxide emissions for 1990 from that group, have approved the treaty (UNFCC). A number of scientists believe fossil-based fuel use is the source of emissions that cause increasing temperatures on Earth (T. Brown 2003, 169-173). While few policy makers dispute warming trends, some argue the uncertainty of the studies overplays the dangers, while others term the results "global warming" and urge action (Carey and Shapiro 2004).

Many events and organizational developments happened in the 35 years preceding the ongoing debates about the Kyoto Protocol. There are now eight United Nations secretariats for environmentalism and climate change. Over 150 major corporations today belong to the World Business Council for Sustainable Development, an international organization that studies practical ways to maintain profit and reduce the ecological effects of modern business practices (World Business Council for Sustainable Development, 2004). Well before these, Rachel Carson in 1962 published what became one of the more influential books in the America environmental movement, one that some would claim marked the start of environmental politics and motivated the changes of the past four decades. The book, *Silent Spring*, claimed that pesticides were killing flora and fauna, preventing births, and creating a spring that would come without the songs of birds. The book electrified, angered and ultimately motivated a wide range of groups, individuals, and policy makers into actions to protect the environment (Hays 1993, 52, 174-5). Some believe Carson's book changed the nature of the environmental movement in the United States (Gore 1994, xv). Regardless whether that dramatic claim of influence is true, I suggest that

Carson's use of metaphor has played a role in creatively and forcefully explaining environmental matters on global and personal levels. Metaphors continue to have an important role in public and policy debates and discussions about the environment.

Goals

That Rachel Carson used metaphor literally in *Silent Sprint* seems readily apparent, even though the book's haunting title was the idea of an editor (Brooks, xv-xvi). Much has been written of Carson's style and rhetoric, but relatively little about the interpretation of her metaphors in light of studies of metaphor and paradigm shifts. This thesis is intended to address the role that metaphor played in *Silent Spring* and to draw from it insights for environmental discourse of the 2000s. The specific goals of the thesis are:

1. To understand the role of metaphor in *Silent Spring* and to use that as representative for a part of the environmental discourse.
2. To understand the relationship of metaphor to science and technology studies in *Silent Spring*, particularly Kuhn's work on paradigms.
3. To identify implications for metaphor use in environmental discourse for the early 2000s.

Assertions

The significance of the research is founded on three assertions: a) Environmental issues will continue to be a subject of policy debate; b) Metaphor will be an important part of environmental and public policy rhetoric and discourse; and c) Metaphor will play a role in developing, explaining, and implementing policy.

Approach

I will present the results of a literature review of writings about metaphor, focusing on recent works by Lakoff and Johnson, Schon and Rein, and Maasen. I will follow with a selective, integrated view of metaphor that reflects my position and beliefs about metaphor, specifically

metaphor utility. The foundation for reviewing Carson's use of metaphor will include an abbreviated study of Carson's rhetoric, relying on Waddell and Herndl and Brown. I will complement the focus on metaphor with viewpoints of Kuhn on paradigms and incommensurability and Wittgenstein on language. With this foundation I will analyze the metaphors of *Silent Spring*, first creating a map of the metaphors, then explaining them in terms of contemporary metaphor theory, Kuhnian paradigm shifts, and the language games of Wittgenstein. This analysis will allow me to identify relevant insights for future environmental discourse, rhetoric, and debate.

Chapter 2: Metaphor—definition through discourse

This chapter sets the foundation for understanding metaphor in *Silent Spring* by focusing on selected contemporary interpretations of metaphors, from definition of metaphor to motivation to application. The analysis of the role of metaphor in thought and discourse considers speakers and listeners. This thesis uses the convention of speaker to mean oral or text and listener to mean hearing oral metaphors or reading metaphors.

Definition and Changing Views of Metaphor

Views on the utility and use of metaphor have shifted over the centuries and current perspectives attribute a power, application, and universality for metaphor not ever hinted at in earlier definitions and interpretations, including a belief that metaphor meaning, use and interpretation can often be a joint effort between the speaker and the listener (Ortony 1993, 2; Lakoff and Johnson 1980, 68). The jointness creates interactivity between speaker and listener that allows metaphor to move beyond mere decorative language. This jointness also means that metaphor is not merely a way to reduce literal statements to build a meaning. Berggren is critical of past interpretations of metaphor when "for centuries metaphor was considered to be nothing more than a stylistic ornament, superimposed on cognitive discourse for emotive purposes, or else a mere illustrative comparison whose possible meanings and truth could emerge only when the metaphor was reduced to literal statements" (Berggren 1963, 237).

Comparison as a foundation for metaphor use is complemented by more complex understandings of the ways that metaphors are created and applied. The inclusion of different elements supports a synthesized analysis: "metaphor constitutes the indispensable principle for integrating diverse phenomena and perspectives without sacrificing their diversity" (Berggren, 237). This integration extends metaphor's role well beyond mere comparison or even explanation into a tool for structuring understanding across a variety of phenomena. A listener to metaphor therefore has to search for meaning, because it may not readily be understood without some investigation and thought. In the thinking is the realization of the connection between message and meaning and that connection is where transference of meaning takes place. The

effectiveness and understanding of the connection determines the success of the transference. Maasen believes that "communication can be observed in terms of whether they [metaphors] *generate linkages* and become condensed into corpora of meaning . . ." (Maasen 2000, 16, emphasis added). Metaphor, by its very nature, uses linkages that establish meaning by creating connections and relationships between things that may not be so apparently alike.[1]

The roles of metaphors continue to be debated and the central issues include arguments about metaphor as: 1) ornamental and an abnormal use of language; 2) a device for merely describing similarities; 3) a way to create new meaning for both terms; or 4) a tool to influence policy and planning. The arguments for a limited role of metaphor include substitution theory, which holds that a metaphor paraphrases the literal, the gist of which some believe is the "starting point for philosophical discussion of metaphor" (Sharpe 1995, 555). Even though the debate may include discussions of literal meaning, in general the understanding of metaphor meaning has moved away from literal equivalency towards a complexity of meaning types that metaphors can provide, depending on how different readers and listeners interpret and use metaphor (Sharpe, 1995, 555). It is in the hearing and interpretation where metaphors support "translation, not identity," meaning that metaphors include more than the literal description (Brown, R. 1976, 184). While there may be some connection with the literal, of more interest and importance is to understand how the "various mechanisms of meaning [from metaphor] shift" and to map their links, relationships, and interplay (Hesse 1972, 253).

The debates include the ways these mechanisms in metaphor produce truth or falsity, although some believe that metaphors are misleading and do not produce knowledge (Hartman 1982, 328). Others, including Black, do not address truth and suggest that metaphors should be interpreted in terms of "correctness and incorrectness" (Black 1993, 39). Regardless, "metaphor as lie" has a strong tradition, with complaints that metaphors can be "incongruous, if not actually false" (Miller 1985, 366). Hartman highlights this in terms of a metaphor's role in declaring "identity . . . A *really* is B." "If this is what metaphor does, then a metaphor is a lie" (Hartman 1982, 328). The use of metaphor therefore can cause clouded understanding and, if a discourse

[1] As far back as Aristotle there was recognition of the difference between the related terms: ". . . metaphors should be transferred from things that are related, but not so obviously so, as in philosophy, too, it is characteristic of a well-directed mind to observe the likenesses in things very different" (Aristotle 1991 Kennedy translation, 250).

relies heavily upon metaphor, it becomes not only unclear, but also difficult to determine if the metaphors are even being "used intelligently" (Horsburgh 1958, 238).

These arguments about metaphors' probity seem to come to arguments that metaphor is misleading or perhaps even "deviant and parasitic" (Kronfeld 1980-81, 15). Part of the difficulty that some have with metaphor apparently comes from a belief that there exists "wording that describes flawlessly, with words of value only those that describe the world literally" (Arbib and Hesse 1986, 149-150). Regardless, the arguments about the truth or falsity of metaphor involve arguments about knowledge and cognitive processing.

These critical views that argue for a limited utility for metaphor have changed radically in more recent times. While some may not support Arbib's and Hesse's argument that "all language is metaphorical," many do recognize a new understanding of the ways that metaphor can contribute to meaning and knowledge. Key are Lakoff and Johnson who argue also that "human *thought processes* are largely metaphorical" (Lakoff and Johnson 1980, 6).

It is unlikely that a majority of analysts of metaphor support the assertion that "metaphor is potentially revolutionary" (Arbib and Hesse 1986, 156). The source of a potential revolution, however, is clearer and includes arguments by Lakoff that metaphors contribute to radically new meanings and knowledge because metaphors are a "matter of . . . thought and reason" not merely descriptions of existing reality (Lakoff 1993, 208). The foundation for the creative thought is in experiences, not in the language (Lakoff 1993, 245).

Equally revolutionary is the argument that metaphor is part of proper, common usage (Black 1962, 52). The concept of proper, common use is supported by experiments that describe how listeners comprehend and process metaphorical meanings in the same way, and as fast, as literal meanings (Glucksberg 2003, 92). The role of metaphor is expanding in these newer interpretations to include metaphor as a creative device that enables new views of the world (Ortony 1993, 5). These new worldviews provided by metaphor contribute to understanding by being more descriptive of a situation. Additionally, certain metaphors, called "generative metaphors," can "frame" situations, create understanding beyond mere description, and can guide or shape particular actions and activities (Schon 1993, 137).[2]

[2] An example is the oft-used metaphor "war" as in war on drugs, war on poverty, etc. If the metaphor is healing, as poverty is a condition calling for healing, candidate actions can be much different.

Metaphor does not merely reflect literal meaning of a single word, but embraces a wider conceptual content that affects cognitions as well as definitions, i.e., a "metaphorical concept" (Lakoff and Johnson 1980, 6). In a related sense, a "metaphor is the tip of a submerged model" (Black 1993, 30). Metaphor is a device that can provide explanation of new relationships in a model and can potentially expand the coverage of a model based on cognitive functions (Brown R. 1976, 174). The transference of meaning and the structure for cognition takes place between or through a topic or target and a source-vehicle-domain. In the example metaphor, "Joe is a saint," Joe is the topic-target and saint is the source-vehicle-domain. (Johnson and Pascual 1989, 1). In this example, the metaphor is inviting the reader to conceive of Joe as a saint and suggests Joe has saintly characteristics, qualities, personality, conduct, etc. This transference of meaning involves the rearrangement of "a whole semantic field," not merely one or a few features. Joe as a saint implies, means, and motivates an extraordinary set of conditions and possible relationships, known as metaphorical entailments, that far exceed Joe as a moral, inspirational, reliable person (Lakoff and Nuñez 2000, 56, 68). This is not a novel, aberrational, misleading description, but an attempt to create a concept of Joe against a backdrop and context of cultural interpretations.

The questions behind the use of metaphor include one of motivation, a concept tied closely to definition, but from the view of the writer. The next section includes a discussion of the motivation for metaphor, laying another part of the foundation for a study of *Silent Spring's* metaphors.

Motivation

Speaker motivation for metaphor beyond literary ornament generally is one or some combination of the following: to communicate some explanation of reality or some possible reality; to describe meaning; to motivate action; to describe and explain the speaker; or to guide action.

New metaphor creation is cyclic, building on past metaphor and generating "a specific model for the explanatory understanding of some aspect of the real world" (Livingston and Harrison 1981, 102). This points out "two ideal types of motivation for metaphor: *correlation* and *intertextuality*" (Zinken 2003, 507). Correlation is not a limited comparison of a set of

possible "truth conditions," but also involves the relationships of the speaker's assumptions about the truth conditions. Metaphor can contribute to the explanation, and therefore listener understanding, of the speaker's assumptions (Searle 1995, 86). The metaphor explains the "speaker's utterance meaning" (Searle 1995, 84).

The dilemma in determining speaker intention involves recognizing the boundaries of speaker meaning, given the ways that metaphor can open up new areas of explanation through the metaphor's entailments and implications. Alternatively, a speaker's motivation to use metaphor to express something non-literally can be problematic for the same reasons (Fraser 1993, 333). In the problem of understanding speaker intentions rests another aspect of motivation, the desire to integrate different interpretations that enables "some favorable redefinition *by each party*" (Miller 1985, 207, emphasis added). The speaker is motivated to define and the listener to potentially redefine. Redefinition through metaphor means that, contrary to some definitions, the boundary of meaning is not necessarily fixed. The metaphors of science show that scientific research "thrives on metaphorical descriptions put forth in an investigative spirit." In this framework, metaphor "serves as an *invitation* to its originator and others to develop its ramifications" (Scheffler 1986, 391). The invitation is useful when the metaphor involves a need to clarify meaning about constructs and in doing so to make "abstract concepts in terms of the apprehendable" (Glucksberg and Keysar 1993, 420). The apprehendable may be symbolic, of "symbolic worlds that may or may not adequately represent certain aspects of the empirical world" (Arbib and Hess 1986, 161). The purpose of metaphor in this case is to describe or to invite others to better describe the world and aspects of meaning in that world. In some cases, metaphors can provide meaning and "constitute worlds of . . . possible meaning" (Maasen 2003, 206). The creation of meaning is in line with analysis that shows the terms of metaphor produce "a new tensional referent whose meaning or being cannot be reduced to either of its interacting components." The relationships of the two terms, source and target, create the new meaning (Berggren 1963, 242, 244).

The explanatory power of metaphor that enables the new referent comes from the "structuring of one experience in terms of another" (Lakoff and Johnson 1980, 77). The motivation in this case is to offer two related experiential referents that can combine to create a new understanding of a new experience. The experiences used to create metaphoric concepts in this case are social experiences and the metaphors themselves can be used also as "cultural

indicators" (Eubanks 1999, 438). Depending on context, a speaker can intend a metaphor to be an early warning indicator of some cultural or impending condition.

More dramatically, metaphors can be used by speakers to construct concepts of new realities and to then motivate readers to act in light of the new framed reality. Lakoff and Johnson are leading proponents of the theory that "(n)ew metaphors have the power to create new reality" (Lakoff and Johnson 1980, 145). Speakers motivated to construct new "social and political reality" can use metaphors to attempt that construction (Lakoff and Johnson 1980, 159). The metaphor "Time is money" is an example of a new reality of time as a commodity offered by Lakoff and Johnson to explain some of the results of the Westernization of global cultures (Lakoff and Johnson 1980, 145).

The implications of metaphors as motivational devices are broad, including the use of metaphors to explain changing reality based on the speaker's membership in a particular "cultural group" (Zinken 2003, 508). From the membership comes the ability of the metaphor and its entailments to guide "further actions" (Lakoff and Johnson 1980, 156). This guidance faculty becomes more understandable with the recognition that a speaker processes to first conceive of the best way to describe reality and the natural tendency to "act according to the way we conceive of things" (Lakoff and Johnson 1980, 5). The action also has special application in areas other than non-scientific social activities where metaphors can be "a means of guiding research" (Boyd 1993, 494).

Metaphors can change reality when they are used to transfer knowledge and power within a discourse (Maasen 2000, 18). It is, perhaps, one of the roles of metaphors and motivations of speakers that the transference function can be most effective causing a new view of reality that, through arresting images, could be radical and threatening

Mapping

The transfer of meaning from the source domain to the target domain is also called "mapping," a term that itself is metaphorical (Fauconnier 1997, 21). Mappings are cognitive and enable "mental connections" and components in "setting up mental models" (Fauconnier and Sweester 1996, 5). Mapping also is called "structure mapping" and is an important tool in differentiating between metaphor and "literal similarity" (Gibbs 1992, 591). The mapping is a

transference "across conceptual domains," moving metaphor from language into thought (Lakoff 1980, 203). Presumably, metaphor creation started with thought before moving into language. Mappings are not arbitrary, nor limited to thought process, but are grounded in body experiences and thus establish a "fixed pattern of ontological correspondences across domains" (Lakoff 1980, 210). Mappings can go beyond simple feature matches and transfers and include "image-schematic mappings" that include physical, experience-based relationships (Eubanks 1999, 426). Mapping does have an element of logic movement and progression in an If-Then context, where mapping permits the operational meaning space—the area where the reader can understand meaning—to move from foundation to broader, more expansive and inclusive meanings (Fauconnier 1996, 146-147). It is in the expansion space that concepts and thoughts are integrated into new "blended" mental spaces (Turner and Fauconnier 1999, 1). The blended space allows new understanding of a metaphor to be constructed, including the addition of "non-counterparts." These are elements that might not be readily apparent from the source or target domains. The additions cannot be arbitrary and there must be cognitive connections between the blended space and the input domains (Turner and Fauconnier 1999, 7-8). The emergent meaning does not, however, come from the source domain and cannot easily be extracted from that domain (Turner and Fauconnier 1999, 2). There is some uncertainty about the way the meaning emerges and the mapping process may be below the consciousness of the listener (Fauconnier 1996, 9). Mapping is cognitive and sophisticated, allowing "a shared mental framework" to "keep in touch with what lies 'out there'" (Beck 1978, 84).

Given that varied approach to structure and the less varied towards mapping, the next matter is cast in terms of where and how metaphor is used, the functional uses of metaphor.

Description and meaning

Metaphor can help better describe, can create images for description or contrast, and is useful for enhancing meaning or even creating new meaning. Beyond explanation and creation, metaphor can frame situations and issues for policy definition, helping to direct action or even allow readers and listeners to experiment with new image relationships created by metaphoric descriptions (Bache 1980, 185).

The use of metaphor as a tool for innovative development of meaning is complemented by a more active role, where metaphor is applied to a situation to frame it for actions, e.g., war on drugs. In this sense, metaphor can serve—consciously or not—to offer a framework for a "potential agenda" (Brown R 1976, 173).

Any metaphor, regardless of use, is a reflection of the speaker's background and perspectives. The application of a metaphor to particular meanings or actions is "subordinate to the speaker's political, social, and individual commitments" (Eubanks 1999, 419). Speakers, therefore, must recognize their own biases in using metaphor, regardless of the particular application, because speakers need cooperation by listeners for perception and certainly for direction. The need for cooperation can be especially relevant if the source of new knowledge and understanding comes from speaker manipulation of relationships between the source and target domains (Black 1993, 35). The speaker uses the metaphor to structure the relationship, whether the goal of use is intended to provide meaning or to only offer ideas in concept development (Ludernik and Freeman 1999, 394).

Metaphor enables the speaker to describe the structure of the primary target domain beyond the limits of literal language and, in some cases, changing the meaning of the literal language (Botha 1986, 374). For example, in "time is money," time becomes a literal commodity. At a minimum, metaphor is useful in filling the "gaps in the literal vocabulary," providing "abbreviations for meaning." These uses of metaphor go beyond the roles attributed by the substitution view, which says that metaphor is used only to describe that which could be expressed literally (Black 1993, 32-33). A speaker is able to use metaphor beyond substitution because the description, i.e., the metaphoric meaning, explanation, and foundation provide meaning for a "system of things," enables the speaker and listener to engage in identifying "associated implications" of the system through the metaphor. The metaphor can be used in this way to apply description and meaning from the source domain to the target domain, allowing the speaker to emphasize, suppress, and organize meaning (Black 1962, 44-45). The speaker in effect is interacting with the listener, inviting the listener to investigate the implications that can provide additional meaning in the metaphor (Black 1993, 28). The listener's interaction with the metaphor makes metaphoric meaning a result of a "product" of interpretation (Gibbs 1992, 587). The speaker bears a responsibility to put the metaphor in context for the listener, to help the

interpretation, and to offer some sense of the speaker's serious intent and circumstances (Black 1962, 29).

The context is especially important because the understanding between context and metaphor, like the changing links between "scientific language and the world," also can change (Kuhn 1993, 539). The speaker sets the context to enable the listener to be alert for particular relationships between source and domain, not to limit, but to base the meaning. The resulting meaning foundation can expand a referent class—the class of relationships preexisting the metaphor—to include new comparisons and relationships (Glucksberg and Keysar 1993, 422-423). The new structure emerging from the changing relationships can lead to new meaning (Bump 1985, 445). The metaphor carries within the structure of relationships a particular meaning, but also an openness that invites "novel conjectures" by the listener that can reveal new meaning and relationships. The "open-textured" quality of a metaphor is not uncertainty or imprecision, but another way to invite the listener to engage in the search for new and different meaning (Maasen, 22). The speaker who wants to exploit the openness to expand a discourse can apply "discursive innovation" and metaphor's "innovating function," transforming a discussion to produce a "new term, a new model, or a new theory" (Maasen and Weingart 1995, 23). Metaphor therefore can be a tool to improve innovation (Bump 1985, 445).

If the speaker is trying to describe a new situation with new relationships, metaphor can be useful in highlighting the familiar—those aspects not expected to change—as well as new areas of meaning. This metaphor use to explain the familiar and create meaning for the unfamiliar is termed "generative" (Schon and Rein 1994, 26-27). A similar term is "constitutive," with the metaphor placing new concepts or objects into the listener's consciousness (Boyd 1993, 486). The speaker can use these metaphor qualities to describe new concepts by introducing new terminology, " a sort of catachresis," that overcomes limits of previous language by pulling the listener into the openness of the new concept (Boyd 1993, 482).

Speakers can use metaphor as a disciplinary tool to maintain consistency, coherency, and structure. Metaphors that appropriate physical objects, e.g., "thermometers and stock market graphs," or physical processes, like movement, e.g., rush to judgment, can be used by speakers in a policy setting to create and maintain political structure and momentum (Lakoff 1980, 241), An example is "the race to the moon." Metaphor can provide more effect than explanation,

facilitating "*socially constructed* epistemic access" to define and apply "complex relational properties" (Boyd 1993, 483, emphasis in original).

Framing

Metaphor, when not limited to symbolic or emotive literary language use, can serve to guide thinking and action, consciously or unconsciously. In the role, mentioned earlier as "generative metaphor" by Schon and Rein, the perspective on a situation or problem acts to shape the problem's definition and, by extension, filters perceptions in or out and shapes or rejects potential actions. A really is seen as B, e.g., urban sprawl as cancer; prohibition as a war on alcohol. The generative metaphor is "an interpretive tool" that is used, consciously or not, for policy analysis and design. The use of the generative metaphor becomes an "interpretive tool for the critical analysis of social policy." Metaphor can be used to frame policy and as a guide to evaluate activities. Using metaphor to change perceptions, "frame restructuring" is closely related to generative metaphor and has similar utility (Schon 1993, 138-139). Metaphor concepts generate image and meaning that have the utility to explain, persuade, and guide (Fernandez 1974, 122).

Generative metaphors help to create frames that policy makers and, presumably, activists, use to focus attention, create strategies, and shape practices. The frames and generative metaphors are not used necessarily for conscious reflection as much as for action, guiding practitioners tools for defending preferred policies, and denigrating alternative policies. The power of this position comes from the generative metaphor's capacity not as a way to prescribe or explain reality, but to simply and categorically describe it (Schon 1983, 309-312). Therefore, the policy maker, if A *is* B, can act in A as she would in B—this is a *war* on drugs and we identify drug users as combatants and fight them as in a *war*. If crime fighting is war, policies can, *and should*, be warlike.

Changing the perspective and creating new approaches calls for a new view, a different generative metaphor, and a restructuring of the frame (Schon 1993, 139). The movement to a new frame can involve a conscious decision to identify, create, and apply a different metaphor. Because the new metaphor can be radically different than the existing frame, e.g., drug use as a health issue, not a criminal/combat situation, the renaming or the "restructuring" of the policy

using a new metaphor allows the policy maker to consider alternatives that otherwise may have been previously rejected as errors, e.g., therapeutic and healing options for drug use do not normally fit in a war of destruction and attrition against drug users (Schon, 1993, 141).

Frame restructuring and creating new generative metaphors are often, if not usually, difficult because the strengths of the existing metaphor and frame are often tacit, beyond the consciousness of the policy maker. The metaphors are "deep" and a part of the restructuring is realizing and understanding the deep metaphors (Schon 1993, 148-149). The deep metaphors can also be called root or macro metaphors (Ortony 1993, 4-6).

Restructuring metaphors offer useful services unless the metaphor loses its power to explain or guide and, instead, become mythic (Berggren 1963, 244). The focus then emphasizes metaphorical absurdity, e.g., "global village," "information highway", etc. The metaphor structure that was so creative becomes clichéd and loses its precision to inform and guide, although it need not become a dead metaphor that has no creative power. The metaphor as myth can still offer a construct to help understand the underlying structure, offering an entry point—much like a model—and calling for complementary and more precise language for more explanation (Livingston and Harrison 1981, 100).

Of some challenge in a democratic society is the problem of competing frames when the generative metaphors are in such disagreement as to be incommensurable, creating situational meanings that are impossible to compare and reconcile (Schon 1993, 151). Frame restructuring, in that case, calls for both or all sides to collaborate on creating a new frame and generative metaphor.

Framing and generative metaphors therefore have another role in innovation, creating new methods and policies. Here the effect is to provide some guide, to create a new frame for inquiry and questioning, and to influence the answers.[3] The metaphor influences by providing structure for questions and answers, but this does not mean that metaphor need limit creativity and the same metaphor can have multiple interpretations.[4] One theme played out in *Silent Spring*

[3] Generative metaphor and frame structuring/restructuring are similar to Kuhnian paradigms, which will be considered in more detail in analyzing the specific metaphors in *Silent Spring*.

[4] As Edge notes in his example of "safety valve" applied to antiwar protestors in the 1960s, the protestors saw themselves as the pressure that would cause the system to explode, while non-supporting, non-protestors saw the protests as relieving the pressure, thus saving the system. "Safety valve" was thus both an action to an end and also an end point itself.

is simply the metaphor of technology as it plays a role in nature. Technology can be a metaphor for control, a traditional machine-like tool for dominance, or a metaphor for cooperation, representing biological techniques that are less destructive to humans, animals, insects, and plants. The preferred frame, therefore, guides innovation, but also through its entailments and implications acts to enforce a moral and social code, i.e., battle versus cooperation (Edge 1974, 136-142). In this sense, there is a cyclical role of establishing and then reinforcing the frame. In *Silent Spring* Carson acted to establish a new frame, introducing alternative ways of animal and insect control slowly through the initial parts of the book, then building to her preferred alternatives in the latter part of the text.[5]

Interpretation

Identifying the message, the interpretation, calls for a structured approach—a "strategy" (Searle 1995, 103) or "some principle of assimilation" (Bergman 1982, 240). At a minimum the interpretation must include "simultaneous" awareness of "*two frames of reference*." The frames are not independent, but are associated with specific contexts that influence the "emergent meaning" (Peters 1978, 362). The context, in turn, is a function of experience and culture, including presuppositions, all of which are essential for interpretation (Lakoff and Johnson 1980, 57). Within the context and cultural influences is a network of relationships that influence the metaphorical meaning (Arbib and Hesse 1986, 170). Because the meaning emerges from relationship analyses, the understanding may not be final, but more a "process of knowing," based on growing awareness of the implications and entailments, the relationships and the meaning that comes with them (Hartman 1982, 334).

The analysis of relationships as a way of understanding metaphor is readily apparent in the interaction theory (Black 1993, 46). At the extreme, metaphor interpretation can create new

[5] The new frame is not one imposed on a reader, as much as it is negotiated between writer and reader (Miller 1985, 205). Carson enters into the negotiation by creating a story, a "fable" (Carson 1994, 1-3). This literary technique is similar to a business tool that became more popular in the latter part of the 20th century, the scenario. Scenarios frequently have metaphoric names, provide a snapshot of some reality, and the best ones are designed to invite the reader to engage in the scenario details and meaning. See Ringland 2002 for a thorough description of scenarios. Miller does point out that changing frames does not guarantee "successful policy." Indeed, other than opening up issues for reinterpretation, Schon and Rein fail to emphasize any need to investigate unintended consequences in the new frame, only assuming that the consequences from the old frame were untenable. Similarly, there is no talk of metrics—how a policy maker uses frames to create measures of success.

categories of meaning, not merely assignment of meaning to existing categories (Livingstone and Harrison 1981, 96). A less extreme view of interaction interpretation seems content to stress the importance of interaction and point out the listener's need to be aware of both subjects in the metaphor relationship, source and target, but rather than compare them, to interpret by looking at the implications of the relationships between the two (Black 1993, 46). Going beyond mere comparison enables the listener to identify the potential variations and complexity of the relationships, which can allow understanding of a new network of interactions that can be mined for interpretation (Arbib and Hesse 1986, 156).

Even where the metaphor says X *is* Y, the *is* reflects more than the literal and includes experiences that the listener will use for interpretation (Lakoff and Johnson 1980, 20). Metaphor is not, therefore, constructed from a static nature of meaning (Searle, 90). Instead, metaphor causes the listener to use experiences for interpretation and possibly to create different meanings (Lakoff and Johnson, 156). Experiences include cultural context, cultural biases, and assumptions that can affect interpretation. A metaphor that provides information in a way relevant to the listener's cultural background is easily interpreted (Glucksberg and Keysar, 418).

The interpretation is not always an extraction of meaning, but can involve creation of meaning. Scientific explanations, especially new theories that might involve "Kuhnian terminology" for new explanations and explanations for fundamental perceptions, can use metaphors to create new meaning and "genuine theoretical progress" (Hesse 1972, 157). Metaphors like channels in cell walls or the ball and stick model for molecules are examples that involved and enabled creative interpretations of scientific terms (Brown T. 2003, 21-23). A similar example is the terminology of queens in beehives and slaves in ant colonies. The terms describe and create "institutional facts"—so-called because institutions call them into existence—where the word used for the metaphoric explanation "appears to be partly constitutive of the fact" (Searle 1995, 37).

Sometimes scientific data are explained in terms of the phenomena observed and then explained anew, using theoretical models to extract new meaning. The models may use metaphor in a way that allows interaction and creation of new insights, e.g., sounds and waves (Arbib and Hesse 1986, 156-157). The metaphor may not be expected, certainly not confirmed before observation, but the metaphor fosters or shapes logic of interpretation. Regardless, the act of interpretation and the effect of the interpretation arise out of images present in the culture (Schon

1994, 27). Simultaneously, the invitation to explore similarities of the source and target enable discovery and new understanding (Boyd 488-89). The interpretation calls for some analysis of the reasoning behind the particular choice of the source to the target, the way that the target can allow the source to fit to the target, and finally the match of the target to the source. The famous observation about the man and wolf applies here: "He is a wolf" changes the way we think of the man *and* the wolf (Black, 41, 44). Even if the literal and obvious seem sufficient, listeners will go deeper, apparently because metaphor invites a closer interpretation in search of greater awareness (Glucksberg and Keysar 1993, 403).

Discourse

Existing discourse is affected by the metaphors that are fundamental to the elements of the discourse (Maasen 1995, 211). In other words, selection of new metaphors is affected by the existence and power of current operational metaphors. The success of a metaphor is reflected in its existence in the discourse (Black 1993, 23). The metaphor's operation in the discourse is explanatory, can be symbolic, and also can help "reorganize reality" (Maasen 1995, 17). Metaphor creation and understanding in the discourse is part of creative activity. Metaphors also act as symbols in the discourse space, representing symbolic acts and interactions (Arbib and Hesse 1986, 169). The constructionist view is that, even though symbolic, metaphors give access to the world through the discourse space—"cultural and natural" (Maasen 2000, 211). Within the discourse, the role of metaphor can be conceptual, but need not be limited to that function and role. Metaphors can connect meaning in a discourse space, but even the same metaphor can be used in specific and different ways in different discourse spaces (Maasen 2000, 206-209). One use is to change the paradigmatic foundation for the discourse and metaphors can revolutionize the approach of a discourse (Maasen 2000, 214). Less dramatically, metaphors can make the discourse more robust, with greater explanatory power, by strengthening the constructs of the discourse (Beck 1978, 83). Still, the metaphor does not operate in isolation, with isolated meaning, but produces meaning in the context of the discourse, even as it strengthens and changes the discourse (Fauconnier 1997, 37).

A metaphor can operate in more than one discourse and the meaning is dependent upon the accepting discourse. Scientific discourses, in particular, frequently import new metaphors

that motivate "continual discourse interpretation and transformation" (Maasen 1995, 23). The propriety of metaphors for a particular discourse are relative to the full discourse space and the purpose of the space (Arbib and Hesse 1986, 170). The metaphor is created with a presumed view of understanding in the discourse (Hesse 1972, 250). The understanding of the discourse, even as the metaphor alters the space, is in the discourse context that creates the tension between source and target domains (Livingston and Harrison 1981, 98). The awareness of the discourse space reality is affected by the construction of meaning in the space as it is as motivated by the metaphor and the listener's knowledge and experience (Ortony 1993, 1). The import of new metaphors in a discourse takes advantage of the knowledge to create new understanding and a potential for guidance and action.

Selective, Integrated View of Metaphor

With apologies to Moliere, it seems that I have been speaking metaphor for much longer than I realize, perhaps even as long as Monsieur Jordain's forty years speaking prose.[6] Perhaps, it would be more accurate to say that I have been living metaphor during those years, because metaphor, in retrospect, has been such a key device in describing experiences and concepts. Regardless of my experiences and use, metaphor is much more than substituting one thing for another, although it is a convenient tool to do that, and it is much more than a literal description from a different perspective. Metaphor goes quickly beyond decorative language and style, and offers a way to engage readers in better understanding an experience, a concept, a policy, even a paradigm. Metaphor offers invitations to readers to search for meaning, but also, and more important for new concepts, to help define the meaning and implications and, in doing so, to establish or reinforce the language rules for the new concept.

Metaphor thereby enables or at a minimum permits writers to be more active and open to setting a stage for interaction with readers by inviting the reader into defining the metaphoric meaning, entailments, and implications. Where non-metaphoric language tends to specify direction or description, usually with some precision, a metaphor can specify operating space,

[6] "Monsieur Jordain: By my faith! For more than forty years I have been speaking prose without knowing anything about it . . ." (Act Two, Scene IV, *The Middle Class Gentleman*, Jean Baptiste Poquelin Moliere).

acting to define the space, but not limiting it. This quality comes from metaphor's utility as a tool to generate and create linkages that might not be so readily apparent. As such, metaphor is a fundamentally creative and provocative tool. Characterizing metaphor as "lie" or "false" may take us down interesting linguistic byways, but fails to recognize the difference between creating a new view of reality, or in more rare cases, a new reality, and mischaracterizing current reality. Metaphor is lie only to those who would have a static viewpoint, fixed in some way that would not enable them to see a situation differently.

Treating metaphor in this way, as a creative device, not only for building new solutions, but better describing current situations, means that metaphor is not uncommon and unusual, but a normal part of discourse, enabling writers and analysts to transfer perspectives and experiences and open up new ways of understanding and explaining. Indeed, metaphor demands engagement by readers, demands that they think about the meaning and context, compare it with their own views, and reject or embrace and expand. The blending of elements in a discourse space is not limited to metaphor writers, but involves readers who will have different elements to consider for blending. For example, the metaphor "silent spring" will involve different elements and blending for a reader experiencing southern rural life than for a northwest US resident, but each will most likely have a core understanding of silence and spring that enables them to build in ways similar to and beyond the intention of the writer.

This creativity and freedom to use metaphor to refine definition should not be implied as a lack of discipline in metaphor creation and application. Choosing, applying, and thinking through metaphor should not be casual, should be related to experience, and should not be simplistic. The ideal metaphor has multiple levels of meaning and possible interpretation that enable diversity of perspectives and a wide space to experiment with policy solutions.

Metaphor's utility builds on its creative function by providing the means to define new approaches, new frames for policy and science. In this role, metaphor can quickly offer a sense of the solution and it is incumbent upon policy makers to understand the implications of the metaphors they use to describe policy directions. Designed and used properly, a metaphor can become a deep or root metaphor for policy structure, providing positive influence or complicating challenges. Using metaphors with images of controlling the environment or forcing nature to yield to human progress, for example, will foster policies much different than a metaphor that suggests human cooperation with nature or a human partnership with nature. Both

sets of metaphors in this example are anthropomorphic and suggest something about nature and about humans, but suggest even more about the policies that might be motivated by those metaphors. Metaphors can be useful in taking incommensurable policies, for example, ones that treat Earth as a commodity to be marketed versus Earth as nurturing mother, and creating frameworks or discourse spaces for discussions about the assumptions that underlay each. In other words, the metaphors may offer some touch points that could permit policy makers to find some commonality. As importantly, metaphors can offer a policy maker a way to create a systems view of the situation and see, at an initially simplified level, the overall view of the matter, e.g., seeing the Evil Empire is a much different systems view than a Partner for Peace. In this way, metaphor is more akin to a model or a topographical map, a representation that captures a sense of the more detailed operational reality, hinting at those things that can be influenced and changed, and suggesting those elements that may be truly intractable.

Chapter 3: Views on Carson's Use of Metaphors

Throughout *Silent Spring* is an apocalyptic theme that argues that unless the chemical solution to all non-human problems is altered, the world is doomed. Many focus on that theme as a reason for the book's popularity and influence, but Waddell believes that those who do that fail to understand that the book more accurately tied into current concerns about nuclear conflict (Waddell 2000, 9). Gartner, in a parallel analysis, argues that Carson's skillful use of warfare terms becomes a "thematic extended metaphor" for pesticides (Gartner 2000, 116). Glotfelty amplified the war theme, noting that not only was war a central metaphoric theme of *Silent Spring* for human actions against insects, but that Carson essentially declared and conducted war against chemical pesticide companies. One early working title for the book was *War Against Nature* (Glotfelty 2000, 170).

Carson significantly did not dispute some aspects of the war metaphor—some insects *were* enemies—but rather that the war strategy was not effective and led to disastrous unintended consequences (Glotfelty 2000, 159-162). The war metaphor was apt for Carson to use because the chemical industry itself frequently referred to war in the early days of DDT use, touting DDT as a necessary weapon against a ruthless insect enemy (Russell 1996, 1507).

Carson also employs home as a key metaphor, one that shows fragility and vulnerability in the face of war. Home for Carson is that place provided by nature for all living things and also is specific human home. In *Silent Spring*, Carson's scientific foundations allowed her the ability to criticize semantic constructions that hold nature as separate from humans and, in fact, work to keep nature as separate. Nature, for Carson, is nurturing and worthy of human respect and contact (Norwood, 1987, 742-744). The lack of respect, built from a lack of understanding and ignorance of the interrelationships in a global ecosystem, threaten the human-built home and the place that is home to non-humanity (Norwood 1987, 753-754). The solutions that Carson offers involve a new way of seeing nature, something that can occur only with a new frame or paradigm in the Kuhnian sense (Norwood 1987, 756). Carson's paradigm includes nature in a variety of roles: female, parent, sibling, friend, even lover (Norwood 1993, xiii). The range of views combined with the metaphor of home creates a framework that calls for a different kind of responsibility. This also implies a different set of responses, especially given the view that within nature's household all life was connected (Norwood 1993, 171). Similarly, "Carson and her

scientific colleagues" saw the world in less hostile terms and more as a "shelter" where animals and humans were both household members. The household metaphor was a tool of Carson's literary style and her scientific training in ecology, which has home as a central, unifying metaphor (Norwood 1993, 151). Carson's effect was to demonstrate through story and metaphor that the "sanctuary of suburban homes" was not immune from the harmful effects of chemicals that were ironically intended to protect the sanctuary.

Herndl and Brown have a strict constructivist view of environmental descriptions, claiming that the environment is "a concept and an associated set of cultural values that we have constructed" through the way we use language (Herndl and Brown 1996, 3). In that context, *Silent Spring* is a "special action" and the discourse space in which it takes place part of a "historically developed cultural frame" (Herndl and Brown 1996, 9). The rhetorical model that Herndl and Brown use to describe general environmental discourse has three parts. The first is ethnocentric—where the humans move into the world using regulation. While the institution is powerful, the representative provides the authority. Anthropocentric is the second and it puts humans outside nature, tending to view nature as an object to be examined, to be understood rationally, and scientifically. The third, ecocentric part views humans and nature in relationship, described poetically (Herndl and Brown 1996, 11-12).

Carson's literary skills reflect an ecocentric approach, especially her recognition of human-nature interconnections, but her scientific background and meticulous references place her firmly in the anthropocentric rational, reasoning camp.[7] Carson's metaphors, on the other hand, threatened the institutions, government and industrial, that supported use of chemicals, but she eventually advocated using better funded government regulation to limit chemical irresponsibility (Carson 1994, 263-297).

Carson's success with *Silent Spring* helped move environmental issues into the public arena, an effect that some attributed to her overtly apocalyptic literary style. She was able to exploit Cold War fears that already recognized the possibility of global destruction through nuclear conflict (Killingsworth and Palmer 1996, 22, 27). The use of apocalyptic language and metaphors marked the speaker, intentionally or not, as an outsider who could see the potential for destruction and expands the discourse to include an invitation to rebel against the dominant

[7] Gartner notes that while many were critical of Carson's science, some of her more aggressive critics "complained that her superb writing made her more dangerous" (Gartner 2000, 1).

ideology, to support change to prevent the apocalypse (Killingsworth and Palmer 1996, 40).[8] Her metaphors were aimed at criticism of chemical production, regulation, and use, not of science in general, but of the way that science was ignoring the problems and consequences of indiscriminate chemical use. In this sense, Carson refuted the general scientific community's claims of continual progress (Killingsworth and Palmer 1996, 29, 33). Nonetheless, she was firmly scientific and her sense of wonder comes from her scientific "identity." There was no move away from "epistemological nature writing" to focus solely on the political. Her epistemological scientific foundation enabled her to understand the dramatic effects of chemicals and allowed her to create stronger arguments that were based on knowledge but more humility and much less arrogance (Slovic 1996, 103-104). More reliance on humility was not a retreat from science, but rather a move to a different scientific framework. Her approach relied on an ecological framework with natural, biologically based control methods. Killingsworth and Palmer believe her approach, relying on the natural, represented a scientific revolution and a Kuhnian paradigm shift because Carson called for a partnership of science, the public, and government regulators. In claiming a paradigm shift, they seem to be emphasizing Carson's work as applying public relations to sound science, i.e., "Carson . . . took her case to the public." For them, if I interpret their arguments correctly, it was moving the natural arguments into the popular arena, expanding the discourse to include the public, and creating the partnership that made Carson's observations and recommendations so revolutionary (Killingsworth and Palmer 1996, 29). That interpretation may capture part of a paradigm shift, but two other factors are of significance in characterizing Carson's work thusly, incommensurability and tracing lifelines. Carson argued for a new approach to pest control, one that did not rely solely or predominately on chemicals. The two positions were incommensurable because supporters of different frameworks/paradigms "practice their trades in different worlds" (Kuhn 1970, 150).[9] Kuhn did not mean that the positions were not comparable at some level, that the languages of the two

[8] The role of outsider as prophet is one well known in apocalyptic religious writings. See, for example, Jeremiah and Isaiah in the Hebrew Testament. Killingsworth and Palmer struggle to identify the reasons for Carson's success, eventually agreeing with Herndl and Brown that it could not be attributed solely to her language, but to "the historical period" (Killingsworth and Palmer 1996, 42).

[9] Margolis speaks of "habits of the mind" when regarding paradigms and argues that a community that holds to a particular paradigm does so through "shared habits of mind," based on experiences and which are used to guide critical intuitions within that community. It is the habits that facilitate intracommunity communications and frustrates extra-community discussions (Margolis 1993, 22-23).

worlds were "mutually untranslatable." Kuhn described incommensurability in metaphorical terms, that it means when two theories are incommensurable, they cannot be translated into the same language "without residue or loss" (Kuhn 2000, 35-36). The worlds upon which the languages are based are fundamentally different and not shared.

Kuhn saw a role for metaphor in those languages. The worlds of chemical dependence versus biologically based practices are examples. The metaphors that might be used for those two approaches require some "referents" (Kuhn 2000, 201).[10] The use of metaphors as referents can act to bring in new terms and concepts to the scientific community or to explain existing terms to new scientists (Kuhn 2000, 197). Metaphors act to relate the natural world with the scientific world and as theory changes or is introduced, the metaphors also change and can provide different entailments and implications, open or hide in different ways, and include different members.[11] The different metaphorical meanings serve to reinforce Kuhn's description of incommensurability; the referents belong to different theories which can be described by different metaphors (Kuhn 2000, 204-205). "Tracing the lifelines" is Kuhn's phrase for following the movement of the referents and presumably the metaphors through the theories.[12]

Carson's use of metaphor combined information and evidence from scientific analyses with policy perspectives and, in the process, created a new paradigm for pest and plant control. I will discuss the new paradigm in more detail later and here will suggest that incommensurability for the new versus the older paradigms involves language for animals-pests, chemicals, and the Earth. While as referents they are present in discourse before and after *Silent Spring* was published, following their lifelines leads to radically different language meanings.[13]

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[10] Lakoff would say that the referent is predominately provided by experience (Lakoff 1993, 239-241).
[11] Kuhn's example is of salt-in-water as a "chemical compound before Dalton and that of physical mixtures afterward" (Kuhn 2000, 204).
[12] Paradigm itself, of course, is a metaphor and using Lakoff's schema, it is a "container" metaphor, because it bounds a category, in this case a category of shared knowledge (Lakoff 1993, 212-213). Kuhn may have taken issue with the more general use of paradigm, because he states "paradigm is what the members of a scientific community, and they alone, share" (Kuhn 1977, 294).
[13] See Crist's work on nature and wilderness which suggests several paradigms for nature, but also criticizes the social constructionists who claim that nature exists only as humans define it by culture, economics, language, and scientific practices. In this sense, nature only has voice when given it by humans (Crist 2004). Carson's work suggests that nature has a loud voice, but humans may not be able to translate nature's language very well. Works, therefore, like *Silent Spring*, do less to give voice to nature than to give hearing to those who cannot hear and translation to those who hear but do not understand.

The incommensurability is explained, in part, by the metaphors of those who see nature to be controlled, ideally and profitably with chemicals, and the metaphors of those who see nature as nurturing and in a more equal, even collaborative, relationship with humans. That relationship, in this latter metaphor, is damaged by overuse of chemicals. The metaphors have meaning within the context of "mutually exclusive epistemologies," backed by interpretations that use different languages (Miller 1985, 195). The incommensurability comes with a gap between the supporters of the different metaphors that makes the creation and execution of policy and regulation difficult, at best, because each side believes it has the relevant facts (Miller 1985, 192).

Confidence in having and sharing the facts is related to confidence in being able to describe the facts. Metaphors can support the description of facts, even if the metaphorical description allows some things to "drop out" (Wittgenstein 2001, 625) The metaphor can lead astray, but nonetheless can be useful in representing physical and mental worlds (Wittgenstein 2001, 629), The interpretation of the metaphor is dependent upon the "language game" which refers to rules by which listeners interpret. Language, however, can shift and to a degree can be indefinite (Wittgenstein 2001, 70-72). This ability to shift does not detract from the utility of the concepts and, presumably, the metaphors.

Metaphors may help answer one of Wittgenstein's questions about meaning: "What would you be missing if you did not *experience* the meaning of a word?" Metaphor, which some believe is based on experience (e.g., Lakoff) can help readers understand the meaning of a word or concept. But Wittgenstein also points out that it is not necessary to explain the language game through experience, but rather to understand that there is an ongoing language game (Wittgenstein 2001, 655).[14] Any game may be one of several that are ongoing and to understand the meaning a listener must understand the particular rules and the "family of language games" in which those rules take place (Wittgenstein 2001, 179).

The gaps in understanding can come from a failure to understand the context of the similarities, which are "family resemblances," in the different language games. The resemblance between languages of incommensurable paradigms and the rules of different language games seems remarkably similar. In either case, the listener must understand the rules, perspective, and

[14] At the same time Wittgenstein claims that "problems are solved" by "arranging whatever we have always known," not by "reporting new experiences" (Wittgenstein 2001, 109).

frame to interpret the words or the metaphor as the speaker intended the metaphor to mean. What Kuhn offers that Wittgenstein only alludes to is the concept of tracing lifelines between the paradigms or the games to understand the resemblances.

One language game is "(m)aking up a story; and reading it" which can provide a new explanation, just as making explanatory remarks changes the nature of descriptions (Wittgenstein 2001, 23-27).[15] Of similar importance is the context, the "situations" of spoken or written words, for example, "naming" is not the same as "description," but it is preparation for description. Metaphor, then, can be a name—*Silent Spring*—or an explanation of a condition, a "silent spring." Naming is similar to putting a game piece on a game board, or choosing an avatar for an online game—it points the way and may even draw out entailments and implications, but it does not necessarily describe (Wittgenstein 2001, 49). In some cases, the name is a sign that points to the paradigm (Wittgenstein 2001, 51). Sometimes, however, the rules for language games can change and with those changes comes different concepts and different meanings for words (Wittgenstein 1972, 105). The "adequate test" of the statements, in terms of truth as the speaker understands it, relates directly to the rules of the operating language game. Truth of the propositions comes from the "frame of the reference." This does not mean that truth is relative to each speaker, because non-truth is a matter of misunderstanding (Wittgenstein 1972, 81). The testing of the statements—"confirmation and disconfirmation"—takes place within a "system" and the boundaries of the system are determined by the argument, presumably by the rules of the language game (Wittgenstein 1972, 105). This would imply that a language game that includes a paradigm defined by a metaphor would constitute a system.

The paradigm name brings no inherent meaning until it becomes the name for a paradigm and without the paradigm, it loses its meaning (Wittgenstein 2001, 55). In this case, the name becomes a proposition because it represents the explanatory power of the paradigm (Wittgenstein 2001, 49).

Paradigms can be forgotten and when that happens we lose "an instrument of our language," it ceases to be a language game (Wittgenstein 2001, 57). One might argue that Carson was not trying to create a new paradigm, but rather trying to remember one that was lost, one where nature and humans were more in balance.

[15] Wittgenstein highlights how different are the words "water" and "water!" (Wittgenstein 2001, 27).

Even with the different rules of the language games, the games are not separate, but have similarities which Wittgenstein calls "family resemblances" that overlap and crisscross, with common touchpoints being at the detailed level or at the higher framework level. The games relate and form a family; even though family members may be incommensurable the family resemblances can enable object tracing between the games (Wittgenstein 2001, 66-68).[16]

[16] Family resemblance, of course, sounds quite similar to Kuhn's lifeline tracing.

Chapter 4: Analysis of Carson's Metaphors in *Silent Spring*

In this chapter I will analyze the metaphors of *Silent Spring,* working from an identification of the root or "deep metaphors" to the variety of secondary metaphors that flowed from and supported the core metaphors. The deep metaphor or root metaphor is the organizing principle of a story (Ortony 1993, 4-6). It is the metaphor that gives sense and presumably meaning to other elements of the story (Schon 1993, 149).[17] I also will attempt to integrate the reliance on experience as a way to create and use metaphor, as explained by Lakoff and Johnson, look at the ways that Carson's use of metaphor in *Silent Spring* helped to fill a rhetorical space, including the creation of a paradigm using rules of a language game, and conclude the analysis by considering the way her policy recommendations fit *Silent Spring's* frame and generative metaphors. Following that, I will address possible implications for 21st century environmental communication.

Evaluating *Silent Spring's* metaphors can, but in this case will not, include literary criticism that focuses on Carson's flowery language. Her books before *Silent Spring—The Sea Around Us, Under the Sea Wind,* and *The Edge of the Sea*—included firm scientific perspectives, explained in a clear, passionate writing style. Similarly, *Silent Spring* was a work of passion and expressive literary style, but the story emerged from the science. One of Carson's biographers observes that because of "Carson's meticulous research and her talent for keen scientific insight and synthesis, *Silent Spring* retains remarkable scientific reliability" (Gartner 2000, 107-108). The scientific research made the story possible and the story took the science to its logical, policy conclusions. At the same time, the metaphor helped to add power to the science and helped to establish the paradigm for a new approach towards the plants, insects, and animals that many saw as inconvenient at best, and enemies, at worst.

[17] I suggest that deep metaphor and paradigm are equivalent. The description of a deep metaphor includes its organizing function, including and rejecting story elements and assumptions (Schon 1993, 149). Deep metaphor also would be equivalent to language game rules, allowing or prohibiting meanings and context for descriptions and arguments.

Mapping the Metaphors

I will use a metaphor, mapping, to identify metaphors in *Silent Spring*. The richness of the metaphors, whether this depth and abundance was intended or not, calls for a couple of different maps, both having a common theme of relationships. The first (Figure 1) is the relationship of action—passive or active—and actor-object—perpetrator or victim. These are mapped across four quadrants defined by two axes. The second map (Figure 2) shows roles over time, taking the changing roles of humans with respect to nature and the effects of humans over time. Figure 2 also is intended to show how *Silent Spring* creates a systems perspective in contrast to a local view of the environment. Carson specifically calls out the "balance of nature" as "a complex, precise, and highly integrated system of relationships between living things," a view quite at odds from those who believed that effects from chemical use were local and limited (*Silent Spring*, 246).

Mapping in this way does carry an obvious flaw in that some maps (e.g., road maps) can give an impression of linearity, when *Silent Spring* emphasizes the nonlinearity of nature and the inability to predict widespread effects on the natural system. Carson notes the uncertain effects of pesticides that spread beyond local areas and wonders, too, about chemical interactions when different chemicals combine in nature (*Silent Spring*, 151-152). Just as a road map is a model for some topographical reality, allowing travelers options for the journey, these maps are intended to show options to travel through a discourse space created by *Silent Spring*'s metaphors. Some detail is sacrificed in any map. These maps do not include all the possible details, but do highlight items of interest and overall views of the discourse.

The First Map: Silent Action and Actors

Figure 1 is presented as a two-dimensional device, with two axes that create four quadrants. The axes, however, are not the traditional X-Y. For victim and perpetrator the axis runs northwest to southeast. For active to passive, the axis runs southwest to northeast. At the center of the map is the first of the two deep or root metaphors, "silence" and "silencing" and the effect of silence in *Silent Spring*. Insects, birds, animals, and humans are the main passive victims, while the chemical manufacturers, sprayers and government agencies are active perpetrators. Nature, because of silent resistance, does play an active role. The public also is a passive victim but also has a perpetrator contribution because of its silence, while the toxins are active but silent perpetrators.

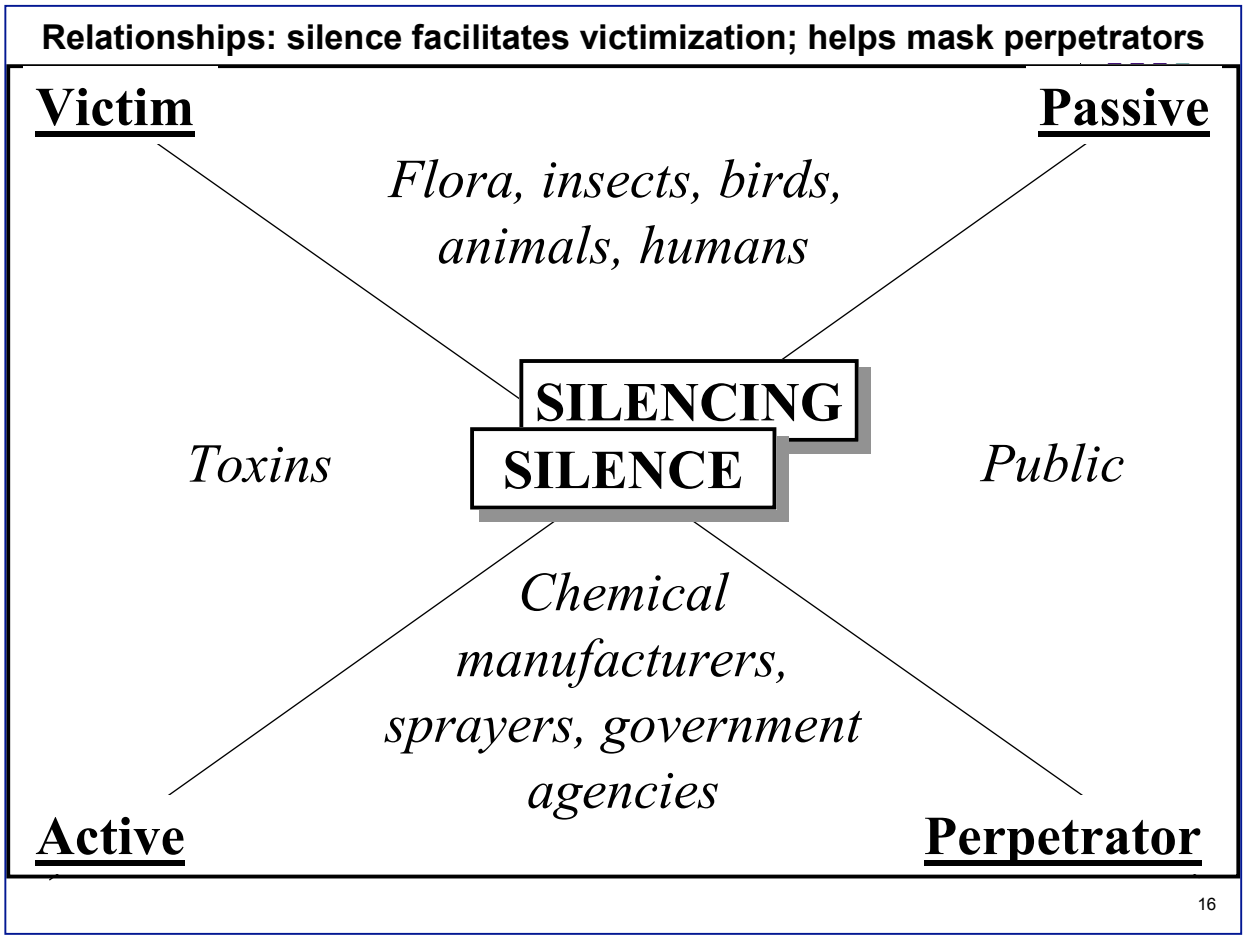

Figure 1: Silence contributes to creating victims and helps to hide perpetrators

The Second Map: Metaphor and Message

The second map is a more general systems map that takes a broad, inclusive view, and will be explained in the remainder of this work.

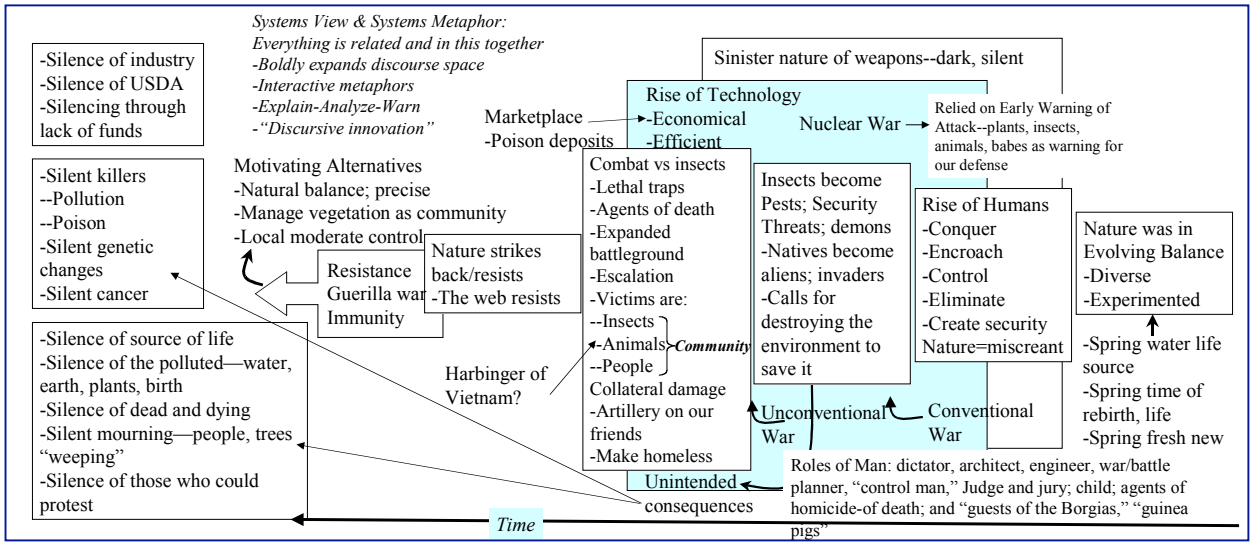

Figure 2: A systems view of *Silent Spring's* metaphors

The Hint of Things to Come: Metaphors in Silent Spring's Table of Contents

Silent Spring's table of contents gives an indication of the book's rhythm, showing a diversity of metaphors that tell the reader that the journey through *Silent Spring* will be one of hope and despair, threat and resistance, and promise. Even more telling is the Schweitzer quote on the frontispiece: "Man has lost the capacity to foresee and to forestall. He will end by destroying the earth." Other than a hint of the scientific sources, some fifty-six pages in the 1994 edition, the science that supports the book is not apparent in the table of contents. Rather, the table sets forth seventeen chapters that can be separated into eight metaphorical groupings.

Chapter	***Title***	***Metaphoric message***
	Titles of the first three chapters set the stage	
1	"A Fable for Tomorrow"	There is a story, with no indication of the type of story, but the Schweitzer quote might indicate that it is an apocalyptic fable.

Chapter	***Title***	***Metaphoric message***
2	"Elixirs of Death"	Here is the first indication of something deceptive, since elixir traditionally has curative life-giving power, but it also is a term associated with quacks and charlatans.
3	"The Obligation to Endure"	It is not clear if this means to survive as a world or to remain firm in the face of some trial or tribulation.
	Titles for Chapters 4-6 tell of the geography of the book and use anthropomorphic titles in 5-6, setting up an idea of Earth's majesty	
4	"Surface Waters and Underground Seas"	There are worlds seen and those not so apparent. This title could be seen as a play on Carson's earlier book, *The Sea Around Us*, and refer to the sea below us.
5	"Realms of the Soil"	Like the seas we cannot see, so too are there sovereignties in the soil of which readers are not, but should be, aware.
6	"Earth's Green Mantle"	Another image of royalty who wear mantles of authority. Readers get the first indications that Earth and nature are not powerless.
	The theme becomes more clear in the titles for chapters 7 and 8	
7	"Needless Havoc"	Something is causing upheaval and perhaps destruction, but the sources and reasons are unclear.
8	"And No Birds Sing"	From havoc to birds without song. The metaphor of silence takes on a more emphatic reason and apparently must be related to the havoc.
	9–11 Titles tell the readers who the agents might be and gives inklings that humans are the source of the destruction and the silencing.	
9	"Rivers of Death"	A frightening contrast to surface waters and underground seas.
10	"Indiscriminately from the Skies"	Images of things falling from above and, given the metaphor of Chapter 9, the things probably are not life giving.

Chapter	*Title*	*Metaphoric message*
11	"Beyond the Dreams of the Borgias"	The Borgias were known for poisoning their guests and the title gives another hint of the situation, that those who appear hospitable may be dangerous. The metaphor "beyond" implies that the limits of human dreams for poisoning may be exceeded in terms of scope and effectiveness and go beyond the intended victims.
12	"The Human Price"	It is in its own category and indicates that the cost of the dreams will involve currency beyond dollars and that the birds are not the only victims of the elixirs and poisons. It also may imply that the human element may be cheapened to achieve some other end.
	Titles for Chapters 13 and 14 are more cryptic	
13	"Through a Narrow Window"	This metaphor could mean a small view into or out of a situation or could imply some escape route through which it is difficult to fit.
14	"One in Every Four"	This title is similarly vague. It could be a statistic of death, disease or damage, or an advertising endorsement.[18]
	15-16 Titles tell the reader that there is a reaction happening and resistance is possible	
15	"Nature Fights Back"	After the vague titles of 13 and 14, this one packs a punch, giving rise to the possibility that the dreams may not be so sweet in the future.
16	"The Rumblings of an Avalanche"	The reader is told of warning signals, perhaps with some hope of averting a disaster, but implying that, like an avalanche, once it begins it will be impossible to halt.
	17-A hint of another way	
17	"The Other Road"	This title suggests another option, maybe even hope and gives an idea of another paradigm, presumably one that is not a poison-laden Borgia dream.

[18] I recall an advertisement that a colleague had tacked to his cubicle wall that claimed that "nine out of ten doctors recommend Lucky Strikes," a popular cigarette of the 1950s.

One more area should be addressed before an analysis of Carson's metaphors in *Silent Spring*, her rhythm and the members of her discourse space. In the discourse space, Carson includes the Earth, nature, and its inhabitants—plants, birds and animals, seas, air and soil, humans, human families, pets, children, and all of these down to the cell level, along with the human manufacturers of chemicals, the chemicals themselves, the government and the scientists. The descriptions of the relationships in the discourse space create a rhythm in the book that is subtle and involves one to five components, in different order in each chapter: the story, the science, the moral question, the claim, and the solution. I will describe some the of the specifics in the early chapters, but as important is the rhythm.

- Chapter 1: Fable and question: "What has already silenced the voices of spring?"
- Chapter 2: Science (thesis); demand—to end the silence based on the "right to know." (13)
- Chapter 3: Science; stories of victims; moral question (comparison with radiation) "Can we be indifferent to the same effect in chemicals that we disseminate in our own environment" (37)
- Chapter 4: Science; claim "nothing exists alone" (51)
- Chapter 5: Science; story; claim "a few false moves . . . arthropods may well take over" (61)
- Chapter 6: Story; science; alternative solution
- Chapter 7: Science; story; moral question "By acquiescing in an act that can cause such suffering, who among us is not diminished as a human being?" (100)
- Chapter 8: Story; science; story; science; moral question and answer
- Chapter 9: Story; science; story; science; moral question
- Chapter 10: Story; science; alternative solution
- Chapter 11: Story, science, alternative solution; moral claim of vulnerability
- Chapter 12: Science; moral claim of continued degradation of Earth
- Chapter 13: Science; moral question; alternative solution
- Chapter 14: Story; science; story; science; alternative solution
- Chapter 15: Science; story; alternative solution
- Chapter 16: Science; alternative solution
- Chapter 17: Alternative solutions; science; moral conclusion

The Hints Realized: Metaphors in Silent Spring's Text

Silence of the Birds, With Humans Close Behind

Silent Spring's opening fable mentioned the sounds of nature that were in a "mythical town in the heart of America"—foxes bark, birds "chorus" with "voices," bees drone. In the first pages, Carson set the metaphor of silence—the silencing of the wild animals, birds and insects, and the "shadow of death" that came over domestic animals, too—chickens, sheep, cattle and the human families—children struck down "while at play." Carson skillfully wove the victims into equity—wild, domestic, and home alike were equally threatened and silenced. At first the perpetrators are the people who "had done it themselves," but in the closing line of the short, three-page fable, she asked "(w)hat has already silenced the voices of the spring," indicating that the people who did it perhaps were not culpable *(Silent Spring,* 1-3).

"Silence" is the deep metaphor for *Silent Spring* because it describes and organizes so many of the core elements of the book.[19] Her early use of silence in the book referred, of course, to the poignant silencing of the "heart of America" whose beat is no longer heard. She made it clear that the heart is more than the people and sets up the argument that stopping the animals, birds, and insects that help make up the heart will stop the heart for all. Her passion and anger, backed by extensive scientific evidence, was served by labeling the government and the chemical industry as silent about the effects from indiscriminate use of chemical pesticides and herbicides. She continually drew the reader back to the scientific evidence, setting up the inevitable question in the reader about the reasons that the chemical industry and government have ignored the scientific findings and maintained silence about the true widespread effects of chemicals.

Carson, significantly, was not an advocate against chemicals, but did contend that "private individuals or public individuals" have been silent about the effects of insecticides. She was not far in time from the McCarthy era of the early 1950s when criticism of government was characterized as unpatriotic and even Communistic. Whether it was conscious or not on her part,

[19] Carson alluded to the metaphor in her earlier work, *The Sea Around Us*, writing of the extermination of birds by alien rats. She quotes Ernst Mayr's observation, without a reference, from an "islander" whose island had been overrun with nonnative rats, "'This paradise of birds has become a wilderness, and the quietness of death reigns where all was melody'" (Carson 1989, 94).

the human victims in her fable were uniquely American and she argued that had "our forefathers" known of the impending problems of chemicals, protections from them would have been a right included in the Bill of Rights *(Silent Spring,* 12-13). The argument was a bold statement that equated the age of her work with the Revolutionary times that produced the Declaration of Independence, Constitution, and Bill of Rights. The argument warned of a need for new guiding documents and a revolutionary approach towards insect and plant control. She implies that, just as America's forefathers recognized a need to prevent certain abuses, their lack of foresight regarding chemicals will need to be corrected by contemporary political action. This is the first step in an argument that will characterize manufacturers of chemical pesticides and certain government officials and agencies as having agendas counter to the best interests of America. It also implies that those who would commit the acts in the fable were un-American.

Exposing industrial misdeeds was not necessarily all new tactics; American muckrakers and investigators had long been critical of certain industries and urged regulation to control their base interests. The anthropomorphizing of industries, creating a human-like persona was metaphor, but also reflected the legal precedent of treating a corporation like a person.

The charge of silence was levied against the government regulators and the chemical manufacturers who committed the double sin of commissioning the production of dangerous pesticides and, more insidiously, were silent in sharing their knowledge about the dangers of the pesticides. She accused the regulators of not only shirking their duties, but also quotes a professional entomologist to create an image of corrupt and ruthless officials who "function as prosecutor, judge and jury, tax assessor and collector and sheriff to enforce their own orders" to conduct spraying operations *(Silent Spring,* 12). This image was repeated throughout the book in different contexts, characterizing the American people as victims, but also implying that the public must become concerned, informed, vocal and active. To do otherwise, she warned, runs the likelihood of condemnation by "future generations."

The public involvement is essential even when the powers that are in control respond with "little tranquilizing pills of half truth" (*Silent Spring,* 13). The metaphor of silence connects to the "tranquilizing pills" that are intended to produce a serene, quiet state and with that comes the image of a silent population. There are implications here, whether intentional or not is unclear, relating the technology of tranquilizers, as something that can be a benefit, and the

technology of chemicals, also a benefit under certain conditions, and both being used against the population.

Withholding truth is silence of the passive kind, induced in a public who is silent because they believe that all is well, based on reassuring half-truths and a lack of education about the threats. To the contrary, the public is comfortable because of efforts by "commercial advertising" (*Silent Spring,* 31). The public too, are victims, in a way more insidiously victimized than the creatures, because keeping the public silent requires cooperative, active efforts by chemical manufacturers and the government who themselves keep silent about the dangers. The perpetrators collaborate to create illusions of beneficial, or at least innocuous, devices. The history of silence is long and not limited to the United States. In some cases, the comfort has become a "legend that herbicides are toxic only to plants and pose no threat to animal life" (*Silent Spring,* 34). As early as the 1930s, the German government declared as secret the properties of chemicals known to be useful in harming insects and humans, essentially cloaking them in a veil of silence (*Silent Spring,* 28). This combination of active efforts, plus a public silent because they are shielded from information, created a silence that enables chemical manufacturers to sell pesticides, regardless of the effects.

Carson was critical of one-sided reports from the chemical industry that touted the chemical triumphs against disease, but which were decidedly silent about the problems that had also appeared. The triumphs, she pointed out, are short-lived at best because of the growing insect resistance and immunity to chemicals (*Silent Spring,* 266).

The toxins themselves work silently and Carson gave them a variety of anthropomorphic qualities: they are "agents of death" and a "grim specter [that] has crept upon us" (*Silent Spring,* 18, 3). They have a "sinister touch" with persistence (*Silent Spring,* 156, 58). There is a sense of the alchemist about insecticides that can "permeate all the tissues of a plant or animal and make them toxic" (*Silent Spring,* 33). Carson did explicitly refer to "alchemistic transformations," referring to toxins that have multiple toxic characteristics (*Silent Spring,* 26). The discussion of human-like attributes will be more developed later in this work. Here the intent is to use the anthropomorphic metaphor to focus on the way they achieve their effects—silently. As toxins, they may "sleep long" and when they awake they do their work in silence (*Silent Spring,* 24).

The chemicals are "stored in the body" like a silent warehouse, more explicitly, "intimately . . .into the very marrow of our bones," or even as a silent bank account, with the

toxins being "small but regular additions to the load . . . building up" (*Silent Spring,* 16, 17, 23). The buildup starts early, in infancy "with the first deposit of the growing load of chemicals" (*Silent Spring,* 23). There, Carson explained, in the body the toxins wait in silence and "lie dormant like a slumbering volcano" (*Silent Spring,* 25).

When the toxins are described as active, Carson's metaphors are varied, graphic, and frequently connected to or reflective of silence and being hidden. They flow through "streams of ground water" and take on a "biological potency" that is expressed at the cellular level, changing body processes "in sinister and often deadly ways" (*Silent Spring,* 15-16). One of the "sinister features" is the way toxic effects of DDT, for example, are "passed on from one organism to another through all the links of the food chain, along the way hiding their presence, and "never detected at all" (*Silent Spring,* 22, 41). In one case, poisons in a lake waters were undetectable, but were present in "the fabric of life the lake supports" (*Silent Spring,* 48). Carson described a variety of similar cases in the chapters on water, "Surface Waters and Underground Seas," earth, "Realms of the Soil," and plants, "Earth's Green Mantle."

Carson built and reinforced the argument that the toxins represent threats to all of life, recognizing that the ecology in the world includes a "web of life" that has all things related (*Silent Spring,* 189). The metaphoric message is strengthened because the toxins are not only undetectable—silent—but also present in a systemic, integrated way, fabric, for example, being a metaphor for interconnected life. The toxins introduced to control unwanted plants and insects are active in some cases in life altering and deadly ways over wide areas of time and geography. The food chain is an example of a connections metaphor that has a wide presence and is affected in a systemic way. She then, however, brought the scale back to the human dimension when she claimed "there also is an ecology of the world within our bodies . . . where minute causes . . . produce mighty effects" (*Silent Spring,* 189). The causes and effects are, of course, silent, with a complementary metaphoric entailment that, in anthropomorphizing the Earth's ecology and relating it to human body ecology, emphasizes the interconnectivity and uncertainties of effects on the body Earth. This also repeats the connections between the silence of the perpetrators and the silence of the toxins.

Taking the description down several layers, Carson described cells as the "burning, living fires [that] spark the energy of life" and the cells are a "miracle," "one of the wonders of the

living world" that "functions as a chemical factory" (*Silent Spring,* 200-201).[20] Carson continued the irony of a silent factory that has "endlessly turning wheels of oxidation" and "bonds of electrons shuttling back and forth at high speed." Disrupting the process can create "a racing engine" that has no functional contribution to life or, even worse, that can "cause mutations," "lead to disease," or "may make their effects felt in future generations" (*Silent Spring,* 202-203, 208). The potential that is now present can be passed on silently to our children and grandchildren. This effect is, in some cases, because of a chromosome "loss" that interferes with cell communication, depriving them of their "instructions" for "normal behavior" (*Silent Spring,* 214).[21]

The specific cellular reaction to the chemicals is unknown and Carson argued that "insufficient time" has elapsed to understand the ways that certain herbicides and insecticides will affect humans. She returned to the silence metaphor when she notes that some human malignancies take "15 to 30 years" to come out of "their period of latency" (*Silent Spring,* 226). During those decades, the toxins are silent and hidden, working at a level not apparent to human senses. The effects on animals are even less known, because in most cases of animals in the wild, humans are not looking or listening. This intensifies the metaphor of silent victims—no way to communicate and no one to listen and hear.

Carson related the way the chemicals work their toxic ways with the language of nuclear weapons. This connection to atomic arms will be developed more thoroughly in the later discussion of the war metaphor, but there also is a relationship between chemicals and nuclear weapons effects in that they can arrive silently, as a "poison drifting out of the sky" (*Silent Spring,* 229). She wrote of the cases of the Japanese fishermen who suffered the effects from nuclear weapon test fallout and of a Swedish farmer who was exposed to "little clouds of dust" that contained DDT. The killers in both cases, one nuclear and one chemical, worked silently at the cellular level to kill their victims. If it is not realized in a short time, the chemicals may be "creating sleeping cancer cells, cells in which an irreversible malignancy will slumber long and

[20] Miracle and living wonder bring to mind a spiritual, if not religious, component to the book that could argue that the Earth is a wondrous gift from a creator. This argument, however, is not developed in any systematic way in the book. This cellular discussion with its references to chemicals could be another harbinger of the new paradigm that is not necessarily anti-technology, anti-industry, or even anti-chemical and starts to lay down the concept that the chemicals need to be compatible with cellular life.

[21] This metaphor is one of genetics as information, a book of life. See Keller for a more comprehensive treatment.

undetected" (*Silent Spring,* 233).[22] A progression of silence is demonstrated then to the cellular level, from the silence of the chemical producers and government agencies through the public, which has been assured of chemical safety.[23]

The last structure that emerges from the root metaphor is the silencing of the victims, alluded to earlier and most apparent in the book's title, which reflects the silencing of the songbirds through death. The opening fable sets the stage: "a strange stillness" . . . "a spring without voices" . . ." ' "morning that once throbbed with the dawn chorus . . ." there was "now no sound . . . only silence" . . . "roadsides . . . were silent." (*Silent Spring,* 2-3). But "no enemy action had silenced the rebirth of new life . . . The people had done it themselves" (*Silent Spring,* 3). The root or deep metaphor takes on a power to guide the book and shape the discourse of the book, describing the particulars that caused the silence and sets up the irony that the humans who chronicled and mourned the loss of spring life's sounds were the cause of the silence. Carson asked about the cause "that has already silenced the voices of spring" and promised "an attempt to explain" (*Silent Spring,* 3).

The metaphor of silencing is quickly connected to a chain different than that of life, a "chain of evil" that comes with chemicals sprayed "on croplands or forests or gardens" leading to a "chain of poisoning and death" (*Silent Spring,* 6). These chemicals are indiscriminate, able "to still the song of birds" (*Silent Spring,* 7). That the music of birds is silenced ties to the opening line of *Silent Spring*, "all life seemed to live in harmony" (*Silent Spring,* 1).

It also begins the setting of the systems framework. While the mourning may be initially for the loss of birds, ultimately the silence will come to all living things, including the human perpetrators. The silence may take generations and be a slow silencing, but the implication is that it will eventually reach all living things.[24] In some cases, the effects may be very fast—one victim spilled chemicals on the skin and died within forty minutes; a dog died within an hour after exposure to an insecticide. Carson used an especially graphic description and metaphor how

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[22] One might see a parallel between Carson's "sleeping and slumbering cells" and Bacon's description of nature sleeping in her chamber with her secrets. See Norwood and Merchant for a more comprehensive discussion of Bacon's metaphors.

[23] Ironically, as I was writing this section, a person came through our housing development, spraying herbicides. When I asked if he was going to put out warning signs to warn parents and pet owners, he responded that all studies showed that the herbicide was "harmless" and assured me, "I know what I am doing."

[24] Carson points out that the insecticide parathion was a widespread suicide tool in Finland and may be implying the connection between fast and individual suicide (silencing) and slow, systemic suicide (species silencing) (*Silent Spring,* 29).

a baby soon "became little more than a vegetable" after coming in contact with the same insecticide (*Silent Spring,* 27). Even professionals are not immune. A chemist was silenced by death almost "instantaneously," unable to take prepared antidotes, after taking a minute amount of parathion (*Silent Spring,* 29).

Chapter 7, "Needless Havoc," summarized the reports of indiscriminate spraying, highlighting the effects on birds, squirrels, pet dogs and cats and humans, as well as rabbits, muskrats, and opossums—all "creatures . . . innocent of any harm to man" who were silenced by pesticides and insecticides. Chapter 8, "And No Birds Sing" followed with a continued focus on the effects, particularly on birds, and repeating some of the metaphoric rhythm of the opening fable: "early mornings strangely silent" . . . "sudden silencing of the song of birds" (*Silent Spring,* 103). Those who "listen for the dawn chorus of the robin throbbing in the early morning light" cannot be assured of that refrain because chemical spraying threatens to "plunge vast segments of the our bird population into the night of extinction" (*Silent Spring,* 105). Night, normally a time of rest, rejuvenation and silence, takes on the metaphor of death and the "plunge" implies that the death is such a potentially deep abyss that it could lead to silencing of the species.[25]

Spraying to control insects becomes equally deadly, a "lethal trap," and traps, of course, work best when silent, without warning (*Silent Spring,* 106). Carson quoted a college professor who describes a sprayed campus as "a graveyard for most of the robins," a metaphor generally in our Western culture associated with a place of silence, mourning, and death (*Silent Spring,* 107). She then quotes a naturalist who says, "Summer mornings are without bird song" (*Silent Spring*, 112).[26] Other creatures are similarly affected by silent killer poisons that "reach out from the seed eaters to the furred and feathered carnivores." Foxes, for example, were found "dazed and half blind," adding sightlessness to the silencing (*Silent Spring*, 124).

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[25] One is reminded of Dylan Thomas' poem "Do Not Go Gentle Into That Good Night" and the line: "Rage, rage against the dying of the light." Carson was certainly raging against the powers that were causing the coming of the darkness. See *Dylan Thomas Collected Poems 1934-1952* (New York: New Direction Publishing Corp, 1971, first published 1953).

[26] Silence with respect to morning makes morning a container metaphor, in the sense that the morning normally has or holds certain things, one of which is the song of birds. The absence of an element implies loss, readily apparent in the woman who asks whether one can "imagine anything so cheerless and dreary as a springtime without a robin's song?" (*Silent Spring*, 114).

Carson used the effects of the silencing in a regular cycle, describing the human goal (controlling a pest plant or insect), the action (chemical spraying), and the effects (silence, death, mutations, blindness). Insecticides against fire ants meant that "opossums, armadillos, and an abundant raccoon population virtually disappeared" in Texas. In Alabama a "spring die-off of songbirds occurred and much good nesting territory lay silent and unoccupied" (*Silent Spring*, 167). In another part of Alabama, quail and "90 percent of the songbirds . . . were lost" (*Silent Spring*, 167).

Nature's Silent Response

Silent are the effects but also silent is nature's response. For those intended victims that are not killed with insecticides, nature is responding with a silent resistance. Because the designers of chemical insecticides have failed to take a systems view, either deliberately or inadvertently, the "balance of nature" has been threatened by chemicals. The balance, Carson was quick to explain, is never static, but in a "constant state of adjustment" (*Silent Spring*, 246).[27] Carson used an anthropomorphic metaphor for nature, for example, "really effective control of insects is that applied by nature" (*Silent Spring*, 247). Nature applies "natural restraints" on living things to keep the balance (*Silent Spring*, 248). She calculated that 70-80% of Earth's 700,000 plus species are insects, "held in check by natural forces" (*Silent Spring*, 249-250). When humans chemically exaggerate those restraints and try to eliminate a population, either fully or from an area, nature resists. Humans generally are not aware of "the protection afforded by natural enemies until it fails" (*Silent Spring*, 249). Carson reported on a series of natural reactions when the protections are removed—infestations by pests previously kept in check and new problems from disease-carrying parasites (*Silent Spring*, 257-258). Even more ironic is the silent resistance by some insects who developed resistances and immunities to the chemicals. By 1960, some 137 species exhibited an ability to resist insecticides (*Silent Spring*, 265). This amplifies Carson's rhythm of hope and despair—chemicals are introduced with much success, nature silently resists and turns the successes into failures (*Silent Spring*, 269-275).

[27] The balance metaphor carries with it an argument that implies that humans might be able to control the balance if we knew all the right components. Carson's descriptions emphasize that it is unlikely that we will be able to gain that understanding.

The reaction to the chemicals, be it the deaths and cancers suffered by animals and humans or the resistance developed by insects, is part of a chain of silence—paralleling the chain of death—that starts with the chemical manufacturers and responsible government agencies and continues with a silent human society kept silent and who remain silent even in the face of growing evidence about toxic effects. The victims who succumb do so in silence at the cellular level. Those whose cells do not yield to the toxins have a natural ability to resist. Thus we see the effect of the root, deep metaphor, silence, throughout the cycle of chemical application and natural reaction.

Reversing the Spring

A complementary root metaphor, not as deep as silence, but nearly as evocative, is spring, with its multiple metaphoric meanings. Silent Spring means, of course, the spring is silent, a metaphorical phrase that changes the meaning of spring and of silent. Spring's normal rebirth is denied and silence is deprived of natural serenity. When a member of Carson's publishing staff argued against the title *Silent Spring*, he charged that the phrase was "blind," that it had no apparent meaning (Brooks 2000, xvi). He was correct in the sense that its meaning was not fully apparent without some knowledge of Carson's story and scientific foundation. At the same time, the meanings are manifold. Spring, typically a time of song, has been silenced and spring is prevented from carrying out its normal role of renewal. The cycle of life that is reenergized, awakened, and emergent after winter is broken carries some worry that the cycle may not restart, that silence will eventually be the state of spring, then summer, fall, and into the winter. Spring is then representative of all seasons. Just as people often grieve more deeply about the lost potential of a dying child or young person, the death of spring, with its promise of new, full life, becomes more poignant, but also much more ominous.

Spring also represents the innocence of youth, the time when youth is vulnerable to the trickster, but in this case the adults responsible for the care of spring and youth have been tricked by those who claim safety in chemicals. The spring that is silenced therefore has the added sadness, grief, and even horror because the responsible adults have acquiesced in the silencing. It is this juxtaposition, silent and spring, that Carson used to lay the metaphorical foundations, her

framing, for translating her scientific arguments into terms that lay people and, presumably, politicians, will understand.[28]

Spring as a word meaning water and spring as a metaphorical term for water plays two roles. The first is the traditional image of water from a spring—clear, clean, and refreshing. These qualities are threatened by chemicals. The waters of spring, provided in part by the melting winter snows, feed and contain the new life that comes with the season of spring, i.e., spring's spring waters. This new life is threatened by the chemicals that have made their way into the waters.

The second role is one more sinister, to apply one of Carson's well-used metaphorical adjectives. This is the spring water that silently carries the toxins to the birds, other creatures, and even humans. In another ironic twist, that which has been a source of life now becomes a silent carrier of death and mutation that "silenced the voices of spring" (*Silent Spring*, 3). Carson contrasted the streams of spring that bring life with those chemicals that come "from our laboratories in an endless stream" (*Silent Spring*, 7).[29] She was methodical in recounting how the streams of chemicals enter the waters, describing it in sketchy detail in "Elixirs of Death" and with greater specification in "Surface Waters and Underground Seas" and "Rivers of Death." She talked of evidence that city dwellers whose water source is rivers have higher rates of cancer (*Silent Spring*, 50). In "Earth's Green Mantle" she shared a story from Justice William O. Douglas about a Wyoming spraying that killed willows and in turn drove away moose and beaver, leaving a "tiny creek," "a bare hot land," and a "living world . . . shattered" (*Silent Spring*, 68). While such incidents, which are reported throughout the book, are troubling to Carson, of even more concern to her are the "unseen . . . unknown and unmeasurable effects of pesticides as the waters make their way to the sea" (*Silent Spring*, 151). Here the metaphor of silent killers is reinforced, not only because of the known effects, but also the unknown, unpredictable effects.

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[28] It is important to recognize the partnership of science and metaphor in this work; they have a metaphorical alliance that supports each other. This alliance, foundation, and framing set forth in the title point to a new paradigm and there the readers have the first indication of the incommensurability of the older, chemically-based paradigm and the new biologically-based, systems paradigm. I will later develop the details of this paradigm shift.

[29] Interesting here is her use of "our" which implies a sharing of responsibility for the labs. It is not clear that she is using the word connected to her scientific background, ownership as a scientist, or as a member of the public that permits these labs to operate with such abandon, or both.

Spring and silence have two more metaphoric entailments, but there are no indications that Carson intended to use them in these ways. The text, however, lends itself to these interpretations. One metaphor is mechanical, the other biological. The mechanical metaphor is that of spring as a coiled clock spring. The mechanical metaphor harkens back to an image of the Earth as machine, a mechanical view that is possibly held by those who fail to see the interconnections of all life on Earth. The metaphor of a silent spring describes the spring unwound, unenergized, the silent clock that no longer keeps the beat of life, and the death of the driving force of the Earth.[30]

The biological metaphor of a silent spring is that of a predator, silently striking its prey, springing on it without warning. Carson described natural predators in "Nature Strikes Back," but the silent springing of chemicals may also be apt, e.g., "he [man] rewards them with a death that is not only sudden but horrible" (*Silent Spring*, 99). Throughout the book, Carson recounted the ways that chemicals, generally pesticides, swiftly attack and kill animals and humans. They "spring" at their victims from hidden places, places thought to be safe—water, food, and air. The kill is quick, but the springing predator metaphor does not follow through. Where the predator attacks for food, not sport, not pleasure, and not control, the chemicals strike, kill, not for food and life, merely for death.

In some cases, the chemicals remain in the stricken victim, ready to strike again should the victim be eaten. In this sense, stretching well beyond Carson's apparent intent, the chemicals are a non-natural serial killer that kill because it is possible, not because it is necessary. Perhaps going far beyond her apparent intent, we find parallels with the control men, the purveyors of chemical poisons, who kill because they can. In some sense, Carson, intentionally or not, equated the persistent silent spring attacks of chemicals with the relentless attack practices of indiscriminate chemical users.[31]

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[30] The clock metaphor was a way to understand the world and, in some cases, the universe, i.e., God as a clock maker, until modern times. See Otto Mayr's *Authority, Liberty, and Automatic Machinery in Early Modern Europe* and Steven Shapin's *The Scientific Revolution*. For more insights into the relationship of machines to the environment see Leo Marx's *The Machine in the Garden*.

[31] It may be of interest to consider whether Carson, if she were writing in 2004, would have tied chemical deaths to indiscriminate terrorist attacks.

Integrating the Metaphors

With that foundation of deep and less deep metaphors, I will look at the ways that those metaphors are related to others in the work. As mentioned earlier, this investigation will consider a time line that moves from a world balanced by natural processes to one that is subject to attempts to balance through chemical processes, using "substances that nature never invented" (*Silent Spring*, 39).[32] The problems that Carson described evolved from a growing sense that Nature was a hostile force that threatened humans, enabling the creation of a control system that required silencing of information about unintended consequences, but eventually leading to a backlash by Nature and ultimately damage to the controllers. Some key points about the metaphors include a recognition that Carson took a systems perspective of Nature, which put humans within the same natural community as the things that humans were trying to eliminate or control. Carson emphasized that the interconnections mean that humans cannot successfully predict the widespread effects that accompany chemical control efforts. She argued for our understanding about the interconnections among all living things, claiming that "(s)eldom if ever does nature operate in closed and separate compartments" (*Silent Spring*, 42); that "in nature, nothing exists alone" (*Silent Spring*, 51), that like the "soil community" we exist in a "web of interwoven lives" (*Silent Spring*, 56), and that there is "a web of life in which there are intimate and essentials relations between plants and the Earth, between plants and other plants, between plants and animals" (*Silent Spring*, 64). These relationships may need to be altered, but alteration calls for a humble awareness that we may not be able to predict the effects (*Silent Spring*, 64).[33]

Carson anthropomorphized nature, but always spelled with a lower case "n," and suggested that nature is a scientist, conducting "long ages of experimentation" to create the right environmental balance (*Silent Spring*, 65). The balance is never constant and is always "in a constant state of adjustment" (*Silent Spring*, 246). The process to arrive at the equilibrium

[32] For a reminder of the approach, please refer back to Figure 2.
[33] Carson presaged the rise of the precautionary principle, more adhered to in Europe than in the U.S., which says that actions should not be taken until proven safe. The usual U.S. alternative is to take and continue actions until they are proven harmful.

existing at Carson's time took "hundreds of millions of years" during which life developed, evolved, and diversified into a more or less balanced state" (*Silent Spring*, 6).

Humans were part of the evolution and as they evolved they wanted safe and secure homes. The power of her opening fable comes, in part, from the threat to home. While the root/deep metaphors are silence and spring, another powerful metaphor is that of home. Carson returns to the metaphor of home throughout the book to emphasize the threats from chemicals to home, especially middle class domestic life.[34] She contrasted in one instance the images of the supermarket displays—"homey and cheerful"—with the realities and threats of the chemical products (*Silent Spring*, 174). Two authors, Vera L. Norwood and Carolyn Merchant, have extensively described Carson's home metaphors, in terms of the Earth as home and the threats to the safety and security of human homes. Norwood also looks to the relationships implied in *Silent Spring*—"Nature as mother, sister, friend, lover" (Norwood 1993, xii). Before Carson, environmental metaphors were fairly general, describing the "esthetic degradation" of nature. Carson was more specific in outlining the threats, in a systematic, yet particular way (Norwood 1993, 146). Norwood argues that Carson's imagery showed the relationships, dependencies, and interdependencies that "made of the earth a household" (Norwood 1993, 171). Carson's imagery did not dilute the scientific perspective. Earth as shelter and a "place where humans live in intimacy with other creatures as members of a household" was meant not to romanticize nature, but to use a different frame to see and analyze nature. Carson's training as an ecologist gave her a foundation in a science "whose central metaphor for describing nature is a household or a home" (Norwood 1993, 151). Even so, home could be an "organic home," an "economic household," or a "combination of both" (Norwood 1987, 741). Carson appears to emphasize the organic in *Silent Spring*.

The home metaphor in *Silent Spring* is useful to understanding the close relationships in the household of the Earth and how chemicals threaten the sanctuary of the home. It is less useful for creating an epistemological approach for understanding nature's system. House and home are too limiting. Norwood argues that Carson expanded home to include "appreciation and respect

[34] Ecology has become the study of global environment, but it originally began as the study of the home environment by Ellen Swallow at MIT. See Anne M. Clifford, "Feminist Perspectives on Science: Implications for an Ecological Theory of Creation," 334-360 in *Readings in Ecology and Feminist Theology*, Edited by Mary Heather MacKinnon and Moni McIntyre.

for the uncontrollable, unknown—even the never-to-be-known—aspects of the world" (Norwood 1987, 743). Carson did expand the concept of home, but the expansion in "Nature Fights Back" and "Rumblings of an Avalanche" were not domestic or homey. They were of a home that, for whatever reason, was being buffeted by outside forces. *The Sea Around Us* by Carson opened referring to "Mother Sea." By *Silent Spring*, there was no "mother" but only nature that was reacting to human assaults. This is nature whose home writ large was being despoiled and who is attempting to regain some domestic balance for the sanctuary of its primary inhabitants, which may not be human.

Carson at the same time saw the home "as a household existing primarily for production, consumption, cooperation, and management" (Norwood 1987, 747).[35] This metaphor is one that also includes factory as well as home, especially in her discussion of the activities of the cells that live in the body, in "Through a Narrow Window." But it is home where she emphasized the dangers using stories about a "baby and the small family dog" (*Silent Spring*, 27), a "farmer's wife (*Silent Spring*, 35), and a "housewife . . . in despair" (*Silent Spring*, 103). The healthy becomes unnatural and insidious: "The common salad bowl may easily present a combination of organic phosphate insecticides" (*Silent Spring*, 32). Even the nurturing mother, perhaps like mother nature, becomes an unwitting contributor to the poisoning: "The breast-fed infant is receiving small but regular additions to the load of toxic chemicals building up in his body" (*Silent Spring*, 23). The problem therefore is understanding the full consequences of the chemical approach to management, caused by a lack of systems understanding: We just do not comprehend how everything is connected (Norwood 1987, 754).[36]

It is against the backdrop of the metaphor of home that Carson built her case against the indiscriminate use of chemicals. In addition to her extensive science foundations, reflected in the fifty-five pages of references that are predominately from scientific publications, Carson skillfully built a critical characterization of the chemical users, planners and manufacturers. She did this by contrasting the chemical effects time line with the time it has taken to populate the Earth with plants, animals, and humans—"hundreds of millions of years" (*Silent Spring*, 6).

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[35] I will discuss Carson's approach towards "management" as part of the discussion of the "control" metaphor.
[36] Ironically, American industries, chemical included, today generally believe in a systems view that considers the integration and control of technology, people, and bureaucracy. See Thomas P. Hughes' *American Genesis* and *The Social Construction of Technological Systems*, edited by Wiebe Bijker, Thomas P. Hughes, and Trevor Pinch.

Carson then compared nature's long history of natural progression with the recent decades that find humans producing a variety of toxic hazards—the atomic bomb and pollution—created under an "impetuous and heedless pace," rather than "the deliberate pace of nature." The slower pace has allowed nature to adapt to past changing conditions, but the human creativity that yearly introduces almost 500 new chemicals does not allow nature the luxury of adaptation (*Silent Spring*, 7).

The rise of humans carries a desire for much faster adaptation and more control. Control is a metaphor that is closely tied to another of *Silent Spring's* key metaphors, war. I will first discuss the control metaphor, then move to an analysis of the war metaphor.

Control—what, how, whom?

The human desire and perceived need for control that is explained and analyzed in *Silent Spring* is rooted in a need for security.[37] This human desire is lived out in light of a sense that nature is fundamentally unfriendly to humans and therefore a "miscreant" that must be controlled (*Silent Spring*, 72). One example is nature's production, in impoverished or disastrous conditions, of "disease-carrying insects" that threaten humans. Carson importantly recognized and supports "control of some sort" in this and similar cases (*Silent Spring*, 9). She did take issue with the "control men" in state and federal government—and of course the chemical manufacturers—who refuse to admit that control efforts are causing dramatic losses of non-threatening birds and animals (*Silent Spring*, 86). Instead, the people who support chemical solutions for control are painted as religious extremists, "on a crusade to create a chemically sterile, insect-free world" supported by a "fanatic zeal" ((*Silent Spring*, 12), looking for "salvation . . . at the end of a spray nozzle" (*Silent Spring*, 114), and conducting a "crusade against insects" (*Silent Spring*, 85). Even worse, in Carson's view, is that the fervor is used against anything "that may annoy or inconvenience" rather than represent any real threat to health and welfare (*Silent Spring*, 126). Carson recognized the power of words in framing the need for control, pointing out that "insects, weeds, rodents, and other organisms [are] described

[37] While control is not a deep metaphor, a word count on an electronic version of *Silent Spring* finds that "control" is mentioned 162 times in *Silent Spring*. See Brenda Miller. This could well be the root metaphor for the paradigm she opposes.

as "pests" in the modern vernacular" and noting that some are considered just "bad" (*Silent Spring*, 7).

The power to make those decisions to control the plants, insects, and other creatures that have been demonized is not shared, but decided upon by an "authoritarian" power (*Silent Spring*, 127).[38] The authorities do not consult and are not restrained, but are "reckless" and out of control (*Silent Spring*, 156). The irony for Carson is that those who would control, for example, the "agricultural engineers," are creating less control. Part of the problem is that the chemical promise of power appeals to child-like perspectives, ones that ignore consequences. For them the chemicals are a "bright new toy" that gives them a "giddy sense of power" (*Silent Spring*, 68). The more fundamental issue, however, is not infantilism, but arrogance, and she works to puncture that overconfidence by criticizing the "would-be architects of our future" (*Silent Spring*, 8). Chemicals are placed in the hands of "persons largely or wholly ignorant of their potentials for harm" (*Silent Spring*, 12).

Only worse than arrogance or ignorance is the denial of those who should know the dangers. They are the ones, for example, who use arsenic, "a favorite agent of homicide from long before the time of the Borgias to the present" (*Silent Spring*, 17). This strong accusation early in the book gets its own chapter in "Beyond the Dreams of the Borgias." There the agents of chemical control are portrayed as more dangerous than the infamous Borgias who feigned hospitality as they poisoned their guests. Not only are the controllers the agents of death with intentions of subduing nature, they have created "the age of poisons to make money" (*Silent Spring*, 174).[39] They lull the "average citizen" with the "soft sell" and claim that those who do not use chemicals to control garden pests are "remiss" (*Silent Spring*, 174). Using chemicals becomes a responsibility. They use innocuous names and market in tranquil domestic scenes (*Silent Spring*, 178). In some cases, the Borgia mentality is such that this unsuspecting "public was to act as guinea pigs, testing the suspected carcinogen along with laboratory dogs and rats" (*Silent Spring*, 224).

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[38] Carson sets up this argument in using the E.B. White quote in the pre-contents: "We would stand a better chance of survival if we accommodated ourselves to this planet and viewed it appreciatively instead of skeptically and dictatorially."

[39] The metaphor is money as a material that can be made or that is a liquid (i.e., liquidity). "The major chemical companies are pouring money into the universities" (*Silent Spring*, 258), or even created: "the fortunes that are to be made in the chemical industry" (*Silent Spring*, 259).

It is this sinister quality that strengthens Carson's use of the control metaphor as a negative force. At issue is not only control, but the limits to and the motivation for the control. She links the sinister quality to human activity in a subtle way early in the book, saying that only "one species—man—acquired significant power to alter the nature of his world." One source of the power is the chemicals which start a "chain of evil" that is irreversible. Chemicals themselves "are the sinister and little-recognized partners of radiation in changing the very nature of the world—the very nature of its life" (*Silent Spring*, 5-6). The "synthetic insecticides . . . have immense power" to affect living beings "in sinister and often deadly ways" (*Silent Spring*, 16). To anthromorphize their role as agents, equivalent to the control men, Carson put them in a "Who's Who of pesticides" (*Silent Spring*, 17). The chemicals have a community of their own where "there are sinister and little-understood interactions, transformations, and summations of effect" (*Silent Spring*, 39). Chemicals also can have a "sinister touch" (*Silent Spring*, 156). To further reinforce the image she refers to a popular, but dark, cartoonist, Charles Addams, and says that "the world of systemic chemicals is a weird world" (*Silent Spring*, 32).[40]

The later parts of the book, especially "Beyond the Dreams of the Borgias" portrayed the relationship more closely, showing repeatedly and relentlessly how the chemical and marketing industries have tried to control not only nature, but the buying patterns of the average American consumer, playing on the "mores of suburbia" and hiding any warnings in "exceedingly fine print" (*Silent Spring*, 177). The relationship of chemical production for home and field also demonstrated how a reader could see efforts to control both the natural and man-made environments as reflecting the inextricable links between the two.

The control metaphor draws its rhetorical power in *Silent Spring* from the connection to motivation, in this case for the chemical industry, a sinister, frightening motivation. The greater effect is from the systems view, the way the sinister effects ripple through the interconnected world in ways known, unknown and unsuspected. In a later discussion I will look at a complementary control metaphor that Carson offered as a solution and a way out of the problems she describes in such detail.

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[40] Carson is explicitly metaphoric: insecticides are not *like*, but *are* a weird world, again changing the meaning of both words—insecticides have this almost independent weird existence; the world is now a strange place because of the chemical presence.

The war metaphor: what's it good for?

The place and time of *Silent Spring* was the United States in the early 1960s. The Cold War, an ongoing confrontation between the Western world, particularly the U.S. and Europe, and the Soviet Union, and one of the tools of the confrontation, nuclear weapons, was in the public consciousness. In some sense, the country was on a war footing and the concepts of nuclear destruction were familiar to many.[41] It also was a governing generation who lived through World War I, II, and the Korean Conflict, understood the power of nuclear weapons, and if not comfortable, was at least familiar with war metaphors.[42] The war metaphor has been well documented, a good example being Cheryll Glotfelty's work that points out that Carson was well aware of the Cold War's position in the public consciousness. In criticizing the Republican administration in 1953 for replacing Albert Day, a strong conservationist and Director of the Fish and Wildlife Service, with a non-professional political appointee, Carson wrote a strong letter to the Editor of the *Washington Post*. The letter concludes: "It is one of the ironies of our time that, while concentrating on the defense of our country against enemies from without, we should be so heedless of those who would destroy it from within" (Lear 1959, 100). Glotfelty notes that one working title of *Silent Spring* was *The War Against Nature* (Glotfelty 2000, 170). Carson reported this war but also "started a new "war" against the manufacturers and pesticide sprayers. Indeed, the war metaphor and the characterization of industry as enemy is still part of the environmental rhetoric of the 21st century (Glotfelty 2000, 159).

Carol B. Gartner characterizes Carson's use of the war metaphor:

> 1. Thus the chemical war is never won, and all life is caught in its violent crossfire.
> 2. The crusade to create a chemically sterile, insect free world seems to have engendered a fanatic zeal on the part of many specialists and most of the so-called control agencies.
> 3. All these [insects] have been our allies in keeping the balance of nature tilted in our favor. Yet we have turned our artillery against our friends.

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[41] I am a member of the American generation taught to duck and cover, to crouch under our school desks in event of a nuclear attack.

[42] For a general discussion of war metaphors, see Sonya K. Foss' "Metaphors and the Rhetorical Invention of Cold War Idealists," in *Rhetorical Criticism, Explanation, and Practice*. Also see Russell.

4. As crude a weapon as the cave man's club, the chemical barrage has been hurled against the fabric of life (Gartner 2000, 116-117).

Carson could hardly be criticized for her reliance on the war metaphor.[43] Edmund P. Russell's analysis of the war metaphor of 1914-1945 showed the reliance on the war image in controlling insects. The benefits of defense technologies in human warfare were carried into insect control efforts. By the end of WW II, Italians, Germans, and Japanese were so demonized that advertisers could use those stereotypes to in turn demonize insects. Russell argues that using a war metaphor made insect control more urgent, prestigious, and more profitable (Russell 1996, 1505-1509). Carson's war metaphor recognized the destruction of the enemy on the battlefield, but also highlighted the threats to noncombatants, what we today euphemistically call collateral damage. Dieldrin, a "violently poisonous" insecticide, is "notorious for striking quickly and with terrible effects," with even those fortunate enough to recover still having "chronic effects" (*Silent Spring*, 25). Doctors who treat human victims of poisons are urged to "wear rubber gloves in handling the victims" and even a "laundress washing the clothing of such victims" could be affected by the poison (*Silent Spring*, 30). Carson, in a rare literary display, suggested sarcastically that the victims are at fault: "Nothing must get in the way of the man with the spray gun. The incidental victims of his crusade count as nothing. If robins, pheasants, raccoons, cats or even livestock happen to inhabit the same bit of earth as the target insects and to be hit by the rain of insect-killing poisons, no one must protest" (*Silent Spring*, 85-86). Likewise, domestic pets are at risk and only the "rare farm in the Sheldon area . . . was blessed by the presence of a cat after the war on beetles was begun" (*Silent Spring*, 93). Carson's reports on unintended victims are long and detailed and use war metaphors: birds "virtually wiped out" . . . "ground squirrels virtually annihilated" (*Silent Spring*, 93); "carcinogenic agents . . . continue to claim new victims" (*Silent Spring*, 241).

The combat model that is implied in the war metaphor is one of attrition. Just as World War II was won in part by overwhelming force and firepower, the chemical assaults are intended to attrit the enemy pests until they surrender or are no longer a meaningful presence. This is a combat model that works well if the enemy can be directly attacked en masse. In the years following *Silent Spring* Vietnam proved that overwhelming force did not necessarily lead to

[43] In some ways her use of the war metaphor reflected the reality of the Vietnam War that heated up in the later years of the 1960s and one of its haunting phrases: "We had to destroy the village to save it."

victory. Even the latest war in Iraq is showing the limits of overwhelming force. Just as the Viet Cong and Iraqi rebels responded with guerilla attacks, nature has reacted similarly and frustrated the chemical war planner. "Nature Fights Back" and "The Rumblings of an Avalanche" outline nature's campaigns. Whether this reaction by nature is characterized as guerrilla warfare or represents an anomaly that cannot be explained by the current approach, the effect is the same—the targets for which the chemicals were intended are being destroyed in far fewer numbers, while victims of side effects and unintended consequences are increasing.

Carson the scientist recognized the need for insect and pest control. She was not even averse to using the war metaphor for her approach, but her use reflects a control strategy that is more focused, with less potential for widespread, unintended consequences. One tactic is deception, using attractants to "confuse the male moth" in what she called "an experiment in psychological warfare" (*Silent Spring*, 286). Another is the use of microbial insecticide that is not "bacterial warfare" but "insect pathogens [that] are harmless to all but their intended targets" (*Silent Spring*, 291). She supported the use of "natural enemies to control the insects that have come uninvited to our shores" (*Silent Spring*, 292). Her only criticism of alternative, war-like tactics was that some, because of funding shortfalls, have not been investigated with precise scientific processes.

Rachel Carson would have done a service if she only had written of the environmental conditions she described in the book and done so as a scientist and skilled writer. She integrated scientific analysis, creating an engaging story supported by scientific evidence and characterizing an industry that was operating in the name of control and causing uncontrollable effects. She did this in part by using metaphors that captured the situation and following the implications to their dramatic and logical conclusions. She also described the metaphoric frames the chemical industry used to create their operations and marketing approaches, as well as the policy developed and applied by the government agencies to support and encourage industry efforts, even in the face of contrary evidence. That this led to loud denunciations against Carson is not surprising. She was criticizing a powerful industry along with the state and Federal agencies that were responsible for public health and welfare. She also was challenging the dominant model for insect and pest control in a fashion that represented the leading edge of a paradigm shift, where the new approach is offered as a replacement for the current "time-honored way of regarding the world" (Kuhn 1970, 6). The source of the new approach is unlikely to be external to the tradition

(Kuhn 1991, 139). Carson's scientific training and experience and rigor made her a formidable candidate to create a new frame.[44] It is important to recognize that her analysis and reporting highlighted one of the conditions for a "scientific revolution"—the old approach was not working; anomalies were occurring that the accepted methods were unable to explain or, in some cases, even recognize (Kuhn 1970, 52; 63-64). In the case of pesticides and herbicides, the application of chemicals frequently provided only temporary relief and resulted in worse conditions than before the treatment. In other cases, new unexpected problems and unintended consequences resulted. The new and unresolved anomalies highlight one other characteristic for a scientific revolution or paradigm shift. The anomalies are enticing only if they represent "something more than trivial" (Kuhn 1970, 145). The models used to address problems have to fail to work in expected, predictable ways and the anomalies cannot be considered marginal. The anomalies thusly represent new problems, which highlight deficiencies in the paradigm and approach.

Paradigms have functions similar to frames in that "they supply the group [of scientists] with preferred or permissible analogies and metaphors." They guide in identifying explanations and solutions, help determine "the roster of unsolved puzzles" and assist in evaluating the significance of unresolved questions (Kuhn 1991, 184).

The frame that Carson criticized had its own metaphors: war, as discussed earlier, being one. "Chemical plowing" was another (*Silent Spring*, 69), "control programs" another (*Silent Spring*, 86), "eradication" a third (*Silent Spring*, 157). The metaphors speak of precision and knowledge that will produce desired and intended effects. Any evidence to the contrary was marginalized, disregarded or denied (*Silent Spring*, 89, 92, 98, 127, 279).

Carson's work in *Silent Spring* created a new frame and changed the meanings of the metaphors used by the chemical industry. She did this by highlighting evidence that refuted the chemical industry model by extensively reporting and by detailing the non-trivial magnitude of the anomalies through, among other devices, the root/deep metaphors and backing those metaphors with connections to specific and numerous cases involving birds, animals, plants, adults, and children. The trivial becomes non-trivial becomes crisis (Kuhn 1970, 82).

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[44] That could explain the attempts to denigrate her science credentials and to attribute her findings as "hysteria" See Carnegie-Mellon *Environmental Decision Making, Science, and Technology*.

The process of creating a new set of meanings made the old and new paradigms incommensurable—they cannot be compared directly (Kuhn 1970, 199). Communications about Carson's approach and the chemical industry model naturally would use different words. Likewise, the metaphors can change and connect to a new "network of similarities through which terms attach to nature" (Kuhn 1993, 539). These connections can be understood as "referents" that allow the same terms to reside in the new and old theories, but in different "natural families." Following the ways that the referents change is a function of "tracing lifelines" (Kuhn 1993, 540). The difference in describing and evaluating the referents depends upon the paradigm which includes a "system of orientation," a particular, usually radical way of characterizing and framing (Scherer and Steinmann 1999, 2). Simply put, "control" for the chemical industry means something much different than Carson's use of that metaphor.

Carson explicitly addresses the incommensurability in *Silent Spring's* last chapter, "The Other Road." She refers to Robert Frost's poem about a traveler facing two roads, roads being a metaphor for choices. Frost was a popular American poet whose public appearances included the presidential inauguration of John F. Kennedy. Frost's inaugural poem, "The Gift Outright," spoke of "Courage is in the air in bracing whiffs" and "emboldened politicians daring to break with followers when in the wrong" (Frost 1962, 28-30). The poem that Carson cited is "The Road Not Taken" with the closing lines:

> Two roads diverged in a wood, and I—
> I took the one less traveled by,
> And that has made all the difference (Frost 1968, 46).

Carson's roads offer two dramatic choices—"disaster" or "preservation" (*Silent Spring*, 277). The paradigms that guide the travelers along those roads are quite different, with the meanings of the words different. Each road, each choice, has a set of family resemblances, things similar that allow comparisons and relationships within the family. The same terms may be in each family but will have lifeline traces back to each term in different families. The lifelines to Carson's terms reflect dramatically different meanings in the new paradigm. War, for example, is not the all out assault based on mere "inconvenience" (*Silent Spring*, 126). Her war metaphor is focused, finite and generally predictable, without the need for the poignant question "whether any civilization can wage relentless war on life without destroying itself, and without losing the right to be called civilized" (*Silent Spring*, 99). This question does not exist in the chemical paradigm.

She argues for war that is selective and safe, with "sanity and perspective" (*Silent Spring*, 99). That observation not only anthropomorphizes the metaphor *war*, but also the paradigm. Essentially, the traveler down the road to disaster has lost perspective and is acting insane, at worst, child-like and deluded, at best, but destructive in all cases.

The control spoken of in the chemical industry paradigm is one that, according to Carson, is based on a belief that reflects confidence and full understanding of the chemicals and their immediate and long-term effects. Carson argued that the anomalies instead show a short-term focus, without regard for systemic effects or interconnections, indeed, there is no place made in that paradigm for systems analysis. The chemical model is that more is more, that victory over unwanted pests and insects is possible and justified and that nature can be subdued. Many of the metaphors in the first sixteen chapters describe the prevailing paradigm and its failures.

Tracing the lifelines to Carson's paradigm à la Kuhn shows that the control referent is first of all a systems setting, a perspective that recognizes the interconnectivity of *all* life, coupled with a humility born of ignorance that motivates smaller scale experimentation within a wide range of conditions and subjects. There is no sense of overconfidence or arrogance that nature can be dominated; indeed, nature is a partner. The core of control that Carson supports is less reliance on chemicals—less is more. The proposed solutions are biological and designing them calls for an interdisciplinary team—"entomologists, pathologists, geneticists, physiologists, biochemists, ecologists" (*Silent Spring*, 178). The lifeline tracing points out an incommensurability in effects—chemical control leads to unpredictable, sometimes dire side effects against humans and other non-targets. The Carson destination does not include that consequence and allows entomologists to step off "the treadmill of chemical control" which produces "a greater menace to ourselves than to the targets." Nonetheless, there even is a lifeline to chemicals in Carson's new paradigm, which recognizes a utility in limited chemical uses, like "chemical sterilants." The metaphor of enemies takes on a different meaning in Carson's paradigm. Rather than focusing on insects in general as the pests, she suggests encouraging the use of insect enemies against the insects that are most troubling. She argued that this is a more natural way of insect control and does not upset the balance of nature (*Silent Spring*, 291-292).

She did not move fully away from the war metaphor, however, when she argued that "(t)here is then, a whole battery of armaments available to the forester who is willing to look for

permanent solutions that preserve and strengthen the natural relations in the forest (*Silent Spring*, 296).

Carson's last paragraph demonstrated the incommensurability between her road and the road of the chemically dependent industry:

> "The "control of nature" is a phrase conceived in arrogance, born of the Neanderthal age of biology and philosophy, when it was supposed that nature exists for the convenience of man. The concepts and practices of applied entomology for the most part date from that Stone Age of science. It is our alarming misfortune that so primitive a science has armed itself with the most modern and terrible weapons, and that in turning them against the insects it has also turned them against the earth" (*Silent Spring*, 297).

Chapter 5: Conclusions and Implications

Conclusions

Silent Spring's metaphors were appropriate and engaging because they help to shape and were presented as part of an integrated frame that included the scientific, social, technical, economic, political, and, of course, environmental. Her background, training and education, and career—including successful science-based books and articles—gave her arguments and metaphors credibility and depth. The metaphors had the rhetorical qualities that would allow connections at the emotional level and patterns at the scientific level. Her integrated use of metaphors reflected her argument and story—that the world hosts a web of life to which everything and everyone is connected. The science has credibility because it is well documented and thorough. The stories have discursive power because the metaphors are systemic and personal, placing the human reader in touch with the effects globally and locally and individually. She essentially created a new set of family resemblances and a new set of game rules for communicating about the environmental effects of chemical herbicides and pesticides. In creating the new rules, in part using metaphors, she created a paradigm that was so fundamentally different that it represented a revolution about and in the understanding of control. The metaphors followed the Kuhnian frame by highlighting the predominant paradigms and non-trivial anomalies that emerged from existing approaches.

Her alternative approach promised to make "all the difference" in handling the threats from dangerous and unwanted insects and pests in a far less dangerous and more effective manner. The two paradigms shared many of the same metaphors—control, war, enemies—but the frame and perspectives were incommensurable. Similarly, tracing the lifelines to the paradigms showed dramatically different results. Carson's road additionally gave no indication of terminating—her discussions about nature's checks and balances and natural resistance indicated a belief in the continuing effort at control.

Silent Spring is an apocalyptic work, warning of the dangers of a way of life that will most likely lead to death and disaster. Like most apocalyptic literature, it issues an alarm from a position outside the dominant power structure. Unlike apocalyptic literature, *Silent Spring*

appropriates arguments and metaphorical language of the dominant power structure and turns it against that structure. This includes using the metaphors of home and family and the tools of science. The same science that creates the chemicals is the science that supports the claims of their dangers. The science is crucial and the scientific findings plus Carson's scientific reputation provide a foundation for the book that is so believable. Without the science the language will still be apocalyptically lyrical and entertaining, but ultimately mythical. The science moves the work from a dark fanciful prophetic tale to a chilling apocalyptic forecast.

On the other hand, the science without Carson's stories and metaphors would have been less informative, less creative, and less engaging, appealing to a much smaller part of the U.S. reading population. Her skillful rhythm and weaving of science, fable, story and passion gave a wider audience access to the book's theme and message and expanded the discourse space for environmental debate. Her metaphors created epistemic access to the science, socially constructing a different awareness of the implications of indiscriminate chemical use.

She was open in her bias, compelling in her evidence, and reliant upon fable and metaphor that were common and invitational. Her clear bias in favor of the Earth and its flora and fauna allowed her to make sharp contrasts with those whose biases were, according to Carson, money and control. Her comparisons and supporting metaphors were understandable to environmental activists and nonactivists alike. The solution set she offered was activist, but she invited nonactivists to engage and become more active.

Her appropriation and transformation of dominant metaphors allowed the creation of a new blended conceptual space, a space with new language rules, and ultimately a new paradigm for pest control. Her new language rules—looking to biological models rather than chemical solutions—created along with the paradigm a new frame for scientific research and action. The new frame, language rules and paradigm allowed the creation of new meaning.

Her metaphors explained the personal and the home, but also created and understanding of the system and emphasized the connection of all things in the system: spring is a universal concept and silencing the spring has a universal effect. She reinforced this by giving stories and metaphors of global cultures and family members—U.S., South American, Japanese.

Her solution, too, was a systems view, inviting a new partnership of science, public, and regulators/legislators. The partnership, I argue, would not have been possible without new language rules that enabled those diverse communities to understand and craft new solutions.

Implications

The world of 2004 and beyond faces difficult ecological challenges similar in nature, but greater in magnitude than Carson's threatened environments. The Earth has new challenges, such as global climate change, only distantly hinted in the mid-20th century. Finally, this section supports attention and action to environmental and sustainability issues and matters. Carson's work has implications that apply as aggressively today as they did in the 1960s. Metaphors can be an effective way to communicate and frame. Global warming, for example, represents a metaphor that, like silent spring, is universal and easily understood at a systems level. Metaphors selected for environmental communications and debates should offer that systems view, a God's-eye perspective of the issues and conditions, and in a way that can connect, appeal to, and invite, even embrace, different cultural perspectives, communities, and individuals. In creating the systems view, however, the metaphor ideally should offer a way to define the system or invite the reader into a definition. For example, global climate change gives a sense of the magnitude of the system and the challenge of understanding the local effects.

In debates of any kind, but especially environmental debates, there will be adversaries. Metaphors selected for characterizing the opposition should start from environmental effects and work back to causes. They should be constructed or selected such that the metaphor for the causative group (e.g., the chemical industry in *Silent Spring*) can be separated from the results. This prevents the risks from demonizing the cause agents, but allowing the effects to stand on their own.

The metaphors should allow definitions on the part of the reader, e.g., what a silent spring would mean to a reader in the Rockies, one in England, India, China, etc. This redefinition relates to the universality of the metaphor and capability of the metaphor to engage readers for multicultural definition and redefinition.

The solution set to which the metaphors point should address the situation in a new, engaging fashion. The problems need not be newly explained or identified, but newly described in terms of a solution, e.g., the idea of partnership to address chemical use.

As fundamental as these implications may seem, the metaphors must be constructed on a foundation of science and scientific results, but also from a clearly defined moral foundation. Injecting morality can be tricky, at best, and the key is to tie the moral metaphors to universals

from which implications and entailments can be affected relatively unproblematic, such as innocence at risk.

In building an approach the emerging explanation should rely on a balance of science and story, to engage as widely as possible. The metaphors should be prophetic, can be apocalyptic, but must offer some sense of hope and policy/technology direction.

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