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The Gendered Eye in the Sky: A Feminist Perspective on Earth Observation Satellites

A major shift in the way knowledge about our planet is produced is now under way, a shift that is likely to have profound consequences for environmental politics in the coming decades. The lion's share of information that will guide international environmental policy making will soon be obtained through the global gaze of space-based satellites. While this sort of knowledge production will no doubt offer many advantages, it has gained ascendancy amid a remarkable absence of critical thinking about its implications. Among participants and observers alike, the expectations are lofty, verging on the grandiose. The view from space is said to offer "unlimited perspectives on ourselves, the world, and the cosmos around us"[1] and benefits from satellite observation that "cannot be overestimated."[2] In the absence of the Soviet threat, satellite technology will be deployed against the "environmental threat" in order "to prevent new ecological and economic 'falling dominoes' and enhance global security."[3]

Yet the celebratory discourse surrounding Earth remote sensing (ERS), as is usually the case with celebratory discourses, serves to mask deeper questions regarding the uses of science and technology in an unequal world. This paper raises some of those questions in the hope of uncovering some unconscious assumptions and resurrecting some unheard voices in conversations about the global environment. In particular, this essay explores satellite monitoring of the earth from the perspectives of feminist theory, asking: What are the cultural and philosophical underpinnings of the planetary gaze, and how might these be played out if the science and technology that generate it are embraced uncritically? The article draws especially on insights from ecofeminism, psychoanalytic feminism, and postmodern feminism.

Earth observation satellites can generate data on an enormous range of issues, including forest cover, the health of crops, atmospheric concentrations of many

pollutants, drought conditions, crisis monitoring, resettlement of refugees, storm warnings, and the locations of many resources, from drinking water to petroleum and mineral deposits to endangered species.[4] During the 1990s, approximately fifty Earth observation satellites will be launched by the spacefaring nations of the world. The National Aeronautics and Space Administration's (NASA) Earth Observing System (EOS), the centerpiece of the Mission to Planet Earth program, will be by far the largest of these ERS projects, with a price tag of perhaps forty billion dollars.[5] The marriage of satellite and computer technology, sometimes referred to as "geomatics," will "make possible quantum leaps in the ability to observe and understand Earth."[6]

Drawing upon feminist approaches that analyze the modern conception of scientific objectivity as a masculine construct and that understand technologies as "valenced" rather than as neutral tools,[7] this article uncovers and critically assesses six fundamental assumptions embedded in the discourse surrounding EOS: 1) the neutrality of science; 2) science as a foundation for rational policy; 3) science as a source of certainty; 4) technology as cause and solution of environmental problems; 5) the globalist impulse; and 6) the perceived needs for planetary management. Each of these assumptions, I argue, is rooted in a paradigm of rationality and control, which is characteristic of androcentric modernity. After making this argument, I ask whether EOS can be redeemed from a feminist perspective and explore the possibility of a postmodern feminist "homesteading," to use a term suggested by the work of Christine Sylvester, of satellite-based Earth observation.[8]

Why Earth Observing Satellites Now?

Although satellite technology is not new—the first environmental satellites were launched in the 1970s—a number of factors taken together have catapulted remote sensing to the forefront of global environmental research in the 1990s. First, the dramatically heightened awareness of environmental problems in general, and "global" problems in particular, has contributed to an increased willingness on the part of national governments to fund satellite observation. Second, recent advances in electronics, telecommunications, and monitoring technologies have greatly enhanced the quality and quantity of data that can be gathered from space. Third, the end of the Cold War stimulated two related phenomena in the late 1980s: a proliferation of international cooperative endeavors in the name of "global security" like the World Climate Research Programme (WCRP) and the International Geosphere-Biosphere Programme (IGBP), both of which rely upon satellite monitoring, and a general conversion of national space technology from military to civilian applications. The United States, primarily through

NASA's Mission to Planet Earth program, has rapidly become the undisputed leader in global environmental research.[9] Yet, while it may be preferable to have Titan rockets launching cameras to photograph clouds rather than to have them launching nuclear warheads or antiballistic defenses, the "peaceful" application of satellite technology to environmental research is not necessarily an innocuous undertaking.[10]

It is worth considering the key catalyst of the remote sensing project: the climate change debates of the late 1980s and early 1990s. In preparation for the 1992 Earth Summit and following on the heels of two world climate conferences in the mid-1980s, the Intergovernmental Panel on Climate Change (IPCC) released its report on the potential effects of greenhouse gases on the global climate system in 1990. That report, representing the work of hundreds of scientists from dozens of countries, concluded that the "unprecedented experiment" that humanity has been conducting on the earth's atmosphere for the last two hundred years will probably produce the most drastic climatic changes since the end of the last ice age. The environmental effects of these changes are expected to include rises in sea level, severe droughts in some regions and flooding in others, and worsening waves of species extinction. Predictions of greenhouse warming are not new; they have been around since the end of the last century, when a Swedish chemist speculated that industrialization and its consequent fossil fuel emissions would eventually warm the planet.[11] What is new, however, is the ability to model this vague prediction using computers in order to achieve an international scientific consensus. Thus, in 1990 the IPCC predicted that the average global temperature will increase between 1.5 and 4.5 degrees centigrade by 2050, a change greater than any since the end of the last ice age.[12]

Of course, if these predictions were taken seriously, then the only prudent policy would be to reduce greenhouse gas emissions, most importantly those of carbon dioxide from fossil fuel combustion. Scientists at the Second World Climate Conference in Rio de Janeiro recommended reductions of 20 percent, but that was only out of political expediency; they actually agreed that a 50 percent reduction was needed to prevent catastrophic climate change. Since the industrialized countries are the main source of the problem and have access to greater technological resources, fairness would require them to bear the brunt of the reductions. In particular, the United States, with 5 percent of the world's population emitting about one quarter of all anthropogenic greenhouse gases, would have to change its patterns of energy consumption the most. The most recent IPCC report, released in 1996 and concluding that human-induced climate change is already happening, has significantly increased the pressure for an international treaty to reduce greenhouse gas emissions.[13]

While most other industrialized countries were willing to freeze carbon dioxide emissions at Rio, with some pledging as much as 20 percent reductions, the Bush administration felt that the scientific uncertainties were too great to warrant significant policy changes. Thus, the largest environmental research project in history, with remote sensing as its backbone, was undertaken in order to "develop more reliable scientific predictions upon which sound policies and responses to global change can be based."[14] Approximately thirty billion dollars will be spent in the United States over the next twenty years to hammer out the uncertainties. Thousands of scientists around the world will spend billions more on global change research, making this loosely coordinated effort likely to become the largest research project in history by 2000. The 1991 budget for the U.S. Global Change Research Program (USGCRP) was almost one billion dollars; the 1996 budget was double that amount. With eleven U.S. agencies sharing the pie, two-thirds of the total budget goes to NASA for its EOS satellites, which will transmit data for fifteen years beginning in 1998. NASA will also build the EOS Data Information System (EOSDIS), the largest data handling system ever built.[15] To put the USGCRP budget in perspective, consider the total budget for the Global Environmental Monitoring System (GEMS), operated by the United Nations Environment Programme, during its first decade of existence: $15 million.

What do we expect to gain from space-based observation that justifies placing the earth's climate systems at risk of unprecedented change as we await greater scientific certainty? The aim of "Earth system science," built upon satellite data, is "to build a comprehensive predictive model of the earth's physical, chemical, and biological processes."[16] No doubt, remote sensing and computerized data processing techniques will generate hitherto unknown quantities of information and "hitherto unknown power for the scientist," as David Rhind has pointed out.[17] In the absence of the Cold War threat, satellite monitoring accompanied by computer-based analytic techniques, will, according to Peter Thatcher, "prevent new, ecological and economic 'falling dominoes' and enhance global security."[18] The "global view" afforded from the vantage point of space is certainly conducive to notions of "global security," but what might that mean in an unequal world? Not only will remote sensing benefit poor countries, we are told, but it will simultaneously serve both U.S. interests and global welfare. But there is good reason to be wary of a celebratory discourse that stifles critical thinking about the nature of these technologies. Must we not be skeptical of a technology that promises so much? If celebratory discourses serve a masking function, then what might be said of the shadow side of remote sensing?

Feminist Perspectives on Science and Technology

Critical approaches to science and technology, including feminist critiques, begin with the premise that these bastions of neutrality are not neutral, but rather originate from, express, and reinforce certain sets of power relations. A critical approach to remote sensing reveals some of the unquestioned assumptions that undergird the celebratory discourse surrounding earth remote sensing, giving preference to those voices that are least likely to be heard. Because programs like EOS and EOSDIS, relying as they do upon aerospace and electronics technologies, are primarily the domain of white men in the wealthiest countries, that means looking at the matter from the perspectives of women and the disempowered.

From those perspectives, six assumptions embedded in most discussions of satellite monitoring may be uncovered. First, the scientists are assumed to be the neutral architects of this global view, despite the fact that they are drawn from a rather narrow segment of the global population. Second, science, taken as a source of neutral information, is taken as a basis for rational policy making. Third, science is believed to generate the kind of certainty needed to guide action. Fourth, the same scientific and technological paradigms that have caused environmental problems on a global scale are thought to be capable of solving them. Fifth, a "global view" is assumed to be necessary, both scientifically and politically. Sixth, once scientists have an understanding of the "earth system," policymakers will have the capacity to "manage" the planet. All of these assumptions are rooted in a paradigm of rationality and control that has characterized patriarchal modernity.

The Neutrality of Science

Taking these assumptions in order, consider the purported neutrality of science and scientists. Since the publication of Thomas Kuhn's work in the 1960s, a great deal of research in the history of science and the sociology of knowledge has undercut this assumption, demonstrating that science, like all social institutions, is suffused with power dynamics and irrationalities.[19] Feminist theorists have highlighted the dimension of gender, elucidating how scientific practice has evolved under the formative influence of a particular ideal of masculinity based upon objectification and control. Feminists relate the fixation on scientific objectivity, which depends upon a rigid dichotomy between subject and object, to other parallel hierarchical dichotomies of modernity: human/animal, mind/body, masculine/feminine, reason/emotion, and elite/mass. Feminists also find in these hierarchical dichotomies of modernity the link between the oppression of women

and the degradation of nature, pointing to the Baconian legacy that summons the scientist "to bind Nature to your service and make her your slave."[20] Women, who have been traditionally defined as objects of control, have good reason to question the subject/object dichotomy.

Evelyn Fox Keller, one of the pioneers of feminist philosophy of science, argues that the static objectivity of science that renders Nature into alien Other is rooted in the distinctive subjectivity of masculine psychological development with its preoccupation with autonomy.[21] Keller's conception of dynamic objectivity offers an alternative stance, one that draws upon the ebb and flow (rather than a rigid dichotomy) between subject and object. While dynamic objectivity, which "actively draws on the commonality between mind and nature as a resource for understanding," is rooted in a feminist psychoanalytic perspective, it is similar to Sylvester's postmodern feminist notion of "empathic cooperation."[22] I return to these ideas toward the end of this article in order to draw out the possibilities of Earth remote sensing informed by feminist insights.

With respect to issues of objectivity, one striking aspect of remote sensing of the environment is indeed its very remoteness. In a sense, satellite-generated photographs of the earth represent the ultimate subject/object dichotomy. Space technology offers the tantalizing prospect of being able to leave the earth in order to get a better view—the ultimate Archimedean vantage point. Rather than being embedded participants in the reality depicted, Earth system scientists become disengaged observers of that reality.[23] Thus, according to the celebratory discourse, remote sensing is "building a valid picture of the earth" for the first time.[24] Presumably this picture is "valid" because it is drawn from huge quantities of objective, remotely acquired information. It is a picture that privileges knowledge derived from abstract science over knowledge derived from lived experience. The main elements of a spaceborne remote sensing system are "spacecraft, instruments, modeling/systems engineering, and data processing,"[25] elements that give primacy to an expert structure comprised primarily of white men in affluent societies. To the question, "Who shall be designated as reliable environmental narrators?" Earth system science answers, "Scientists with professional credentials in physics, chemistry, and computer sciences—particularly those whose work is most distant from the everyday lived experience of poor people and most women." Whenever quantifiability monopolizes the mantle of legitimacy, qualititative values are given short shrift, so that even if satellite data are supplemented with "ground truth," the privileging of abstract decontextualized data is likely to devalue other approaches to knowledge.[26] In particular, as a male-dominated activity, it may reinforce the division of labor that Joni Seager suggests permeates environmental politics: Women *care* about the environment and men *think* about

it.[27] A strong feminist position need not valorize caring as the only viable activity, but can rather insist that environmental preservation requires both men and women to become caring *and* thinking.

The science and technology of satellite monitoring of the global environment also fail the neutrality test from another perspective, when developing countries are taken into account. Not only is the "remoteness" of remotely sensed data emblematic of a masculinist bias, it also exemplifies the schism between the rich and the poor. The multicolor renditions of satellite images, which can only be deciphered by experts with access to specialized equipment, illustrate the cultural and socioeconomic gap between the scientists who produce them and the lived experience of most of the world's people. The fact that satellite data must be converted to visual images, a task that requires highly sophisticated imaging technologies, also illustrates the difference in how experience of the world is gained by scientists in contrast to most people. Given the historical record, it is not at all certain that those images and data will serve the interests of those whose material survival is continually in jeopardy.

Consider the controversy over measurements of greenhouse emissions, information that would appear to be derivable through objective means. During negotiations for an international climate change convention leading up to the Earth Summit in 1992, the World Resources Institute (WRI), a U.S.-based environmental nongovernmental organization, published its country-by-country estimates of greenhouse gas emissions. Without any attempt to frame its data in terms of emissions per capita, WRI concluded that India, China, and Brazil are among the top five countries responsible for global warming.[28] In a rare instance of a challenge to Western science emanating from a developing country, two scientists from the Center for Science and Environment (CSE) in New Delhi argued that both the WRI figures and conclusions were wrong. Starting with the premise that "there is no reason to believe that any human being in any part of the world is more or less important than another," they ask: "Can we really equate the carbon dioxide contributions of gas-guzzling automobiles in Europe and North America (or, for that matter, anywhere in the Third World) with the methan emissions of water buffalo and rice fields of subsistence farmers in West Bengal or Thailand?"[29] The WRI–CSE controversy was not merely scientific; it reflected deep dissension over moral and political responsibility. As subsequent commentators noted, the WRI study implicitly "recycled an old scare tactic: What if the poor rise to the average level of per capita greenhouse gas emissions as the rich?"[30] Without explicitly focusing on this issue, the CSE report attempted to shift the blame for global warming from population to consumption. While developing countries rarely contest the neutrality of Western science, we can expect such

controversies to become more common if research agendas and environmental data continue to be dominated by industrialized countries.

Science and Rational Policy

Turning to the second assumption, let us consider whether science really does tend to generate rational policy. The belief that it does is a fundamental tenet of "the rationality project," a term Deborah Stone uses to describe the attempt to reduce politics and policy to rational analytic frameworks. This quintessentially masculinist orientation to social life, which interprets all social action through the lens of rational self-interest, "misses the point of politics" since "paradox is an essential feature of political life."[31] The dichotomy between reason and emotion implicit in the rational policy model is one of the dichotomies characteristic of patriarchal modernity.[32] The stated purpose of the global change research, with its heavy reliance on EOS data, is to generate the scientific knowledge that will enable policymakers to make rational decisions; science is assumed to lead to rational action. Scientists and policymakers alike envision a linear process that proceeds from recognizing potential problems in the earth's ecosystem, to understanding the implications, to evaluating potential remedies, to implementing remedies and monitoring them.[33] Yet so much of the research program is devoted to pure science, with human activities included seemingly as an afterthought, that the next generation's policymakers will likely be more confused than today's. Research on policy options received only thirty-five million dollars of a total 1995 USGCRP budget of 1.8 billion dollars, which represented a doubling of the 1994 figure.[34] Predictably, to the extent that social scientists have been involved in the research, their analyses tend to be economistic rather than based upon human needs or cultural analyses.

The dearth of attention paid to human factors reflects a notion of neutrality embedded in modernity's hierarchy of the sciences, a hierarchy that elevates the sciences most remote from everyday experience, especially physics, to the apex of knowledge systems. The earth-system-science view of global change highlights atmospheric physics, geophysics, and chemistry, thus rendering human beings virtually invisible. But if the IPCC scientists are correct in surmising that global environmental change is imminent, then the agents of that change are almost exclusively human beings. From the perspective of the social sciences, global environmental change is a process where people are both the cause of change and the object of change—some much more so than others. It is a result of certain social choices and commitments, whether conscious or not, and will only be ameliorated by alternative choices and commitments.[35] But from the perspective

of remote sensing, human agency vanishes and global change is reduced to physical processes. Since the "valid picture" transmitted from space omits the main element of the picture, it is a dubious impetus for "rational policy."

If history serves as a guide, the mammoth scientific undertaking embodied in the USGCRP is unlikely to become a principal catalyst for policy change—even when the results are in after two decades. The nearest approximation to a historical precedent is the ten-year, half-billion dollar interagency program intended to guide U.S. policy on acid rain, the National Acid Precipitation Assessment Program (NAPAP). Although NAPAP was applauded for its scientific achievements, in the end it was virtually irrelevant to the acid rain controls adopted in the 1990 Clean Air Act. Very little of the NAPAP research was policy-relevant, the reports were not timely, and they were "largely unintelligible to Congress."[36] Given current trends in global change research, the USGCRP seems poised to follow in NAPAP's footsteps, although at perhaps sixty times the cost.

Contrary to the rational policy model, environmental policy is not steered by science. In 1991, EPA administrator William K. Reilly commissioned an independent study to examine how his agency employed scientific data in its decision-making process. The report concluded that, to a great extent, EPA decisions are based upon extrascientific factors.[37] Although environmental policy making is a more contentious process in the U.S. than it is in many other places, there is no strong evidence that science serves as the primary guide to policy elsewhere.[38] Science does not provide the objective facts from which policy decisions are rationally deduced. Rather, scientific information tends to be framed and interpreted according to preexisting discourses. As I have argued elsewhere, this was the case even for the global ozone negotiations, where a comprehensive international assessment representing a scientific consensus was available to all parties.[39] Often as not, the same scientific information can be used to bolster an array of policy positions. If "irrationalities" tend to supplant scientific knowledge in the policy process for other environmental issues, how much stronger will this tendency be for an issue like greenhouse warming, which goes to the heart of industrial civilization's dreams and aspirations?

Science and the Quest for Certainty

So even if the USGCRP and international projects resolve the uncertainties, historical experience suggests that they are unlikely to be formative influences in policy decisions. But what of the third assumption, that scientific information tends to generate increasing certainty? No doubt, remote sensing will generate unprecedented quantities of data. EOS will produce one terabyte of new incoming

data each day (a terabyte is 10^9 bytes); EOSDIS will be the largest data-handling system ever built, with a total capacity of fourteen petabytes (a petabyte is 10^{15} bytes). But if this is information that masks agency or renders it invisible, it will be empty information. Programs like the USGCRP will generate information, but will they produce understanding? Once fourteen petabytes of data are gathered, assessments will be required in order to make sense of it all. Because environmental change is global in scope, these assessments will have to be international. International science is always negotiated science and therefore unlikely to generate consensus. Consider the consensus on the imminence of greenhouse warming that was reached by the IPCC in 1990 and 1992. A small handful of dissenting scientists out of a total of several hundred questioned the accuracy of the report's conclusions, thereby providing ammunition for those policymakers who opposed precautionary action. Even in the ozone negotiations, where the science was comparatively refined, the international assessment that served as the basis for the negotiations was interpreted as supporting a huge range of policy positions.[40]

Yet the assumption that science generates certainty is wrong not just because of the political purposes that scientific information serves, but because it is based upon a popular but mistaken understanding of the nature of science. The conventional view, which abounds in the literature on global change and satellite monitoring, is that science enthusiastically embraces and pursues uncertainties. But this is not how science operates. Rather, as Brian Wynne argues, science proceeds by selectively ignoring significant uncertainties.[41] As philosophers and historians of science since Kuhn have recognized, this state of affairs is normal, not pathological. Science could not function if it pursued all uncertainties persistently; thus, it "gives prominence to a restricted agenda of defined uncertainties, leaving invisible a range of other uncertainties, especially about new situations."[42] As Wynne argues, this fact—that ignorance is endemic to science—is only a problem when it is disregarded, causing the scope and power of scientific knowledge to become exaggerated and the social commitments built upon that knowledge to grow dangerously inflated. The danger arises because as our technological systems grow larger, more elaborate, and more tightly interlocked, we can tolerate less uncertainty; difficulties in one part of the system can precipitate disaster in another.

These issues raise a fundamental question that needs to be asked of the USGCRP and related scientific endeavors: If ignorance is endemic to scientific knowledge, what burden of proof can science be expected to sustain? Programs like the USGCRP seek, in effect, to bring climate change and other global

environmental problems under the rubric of the risk assessment model by supplying the information from which risks will be calculated and policy determined.[43] That model incorporates the probabilistic dimension of environmental risks into the rational policy model.[44] It entails a particular reading of nature as a mechanical system with deterministic (albeit interactive) processes, which ecofeminists have pointed out is specifically the view of nature associated with patriarchical modernity. Yet of all "systems," the earth's climate system is among the least amenable to risk assessment. As the chaos theorists have demonstrated, it epitomizes the dynamics of a stochastic, as opposed to deterministic, system.[45] Paradoxically, incorporating more detailed information into models of stochastic systems may generate more uncertainties in the conclusions.[46] Thus, the earth system science that sustains the remote sensing project seems especially unlikely to generate scientific certainty. Perhaps the quest for scientific certainty, which will be extremely elusive in the case of climate change, may not be as helpful in generating policies to reduce greenhouse gas emissions as efforts to reorder economic and technological priorities.[47] Quite possibly, thirty billion dollars spent on researching alternatives to fossil fuel consumption could provide more environmental benefits than a program that seeks scientific certainty. Some preliminary studies along these lines suggest that conservation measures alone would result in economic savings while significantly reducing greenhouse gas emissions.[48]

Technology as Cause, Technology as Solution

This brings us to the fourth assumption underlying the remote sensing project: that a science and technology based upon the same assumptions that have been instrumental in causing global environmental problems will be instrumental in solving those problems. Uncovering this assumption highlights environmentalism's more general ambiguous relationship with science and technology. On the one hand, the Baconian legacy of knowledge as power and technology as domination seems to be responsible for the worst cases of environmental degradation. The "interrogatory" method of science,[49] along with its technological feats, has either colonized or destroyed nature on a planetary scale. On the other hand, scientists often bring cases of environmental destruction to light and serve as defenders of nature. Moreover, if certain technologies are the problem, then alternative or "appropriate" technologies might provide the solutions. Rather than succumbing to the temptation to reject science and technology altogether as enemies of the earth, perhaps we should examine the assumptions embedded in remote sensing programs to see whether they tend to reflect the first or second view of science and technology.

Such an examination, however, suggests that earth remote sensing, at least in the mainstream, is most likely to fit the interrogatory model of science as power. The ultimate goal of the undertaking is to *predict*, which, as Francis Bacon recognized over four hundred years ago, is exactly how knowledge becomes power. Earth system science aims to uncover nature's secrets in order to enable policymakers to "manage the earth." The celebratory discourse surrounding the undertaking reflects just such an uncritical acceptance of this ambition. Thus, we are told, with no apparent sense of irony, that:

> New space-based monitoring technologies backed by powerful information systems will make possible quantum leaps in the ability to observe and understand Earth. . . . It is obvious that the key to the secrets of the earth system lies in advanced organization, big science, big technology and, of course, big money.[50]

NASA, the principal recipient of this big money, waxes eloquent on the cover of its colorful Earth System Science literature, quoting Goethe: "Whatever you do, or dream you can, begin it. Boldness has genius, power and magic in it."[51] There is surely an element of salesmanship here, as NASA seeks to justify its budgetary requests in an era of fiscal conservatism, but in this case the salesmen seem to have swallowed their own snake oil. Rather than standing back from modernity's dream of power through knowledge, NASA embraces it wholeheartedly in its grand vision of a comprehensive understanding of the earth as a system. How the power and magic will be manifested remains to be seen, but there is good reason to wonder whether the remote sensing project will be environmentally benign.

Just as the assumptions about the nature of science implicit in satellite monitoring are rooted in Baconian thinking, the assumptions about technology are rooted in the modernization paradigm. Even when information is made available at no cost to developing countries, which is by no means always the case, remote sensing is still a technology that is likely to benefit industrialized countries the most. Research agendas are largely set in the West, the space and computer technology are owned by the North, and the results are published in English. When satellite data reveals mineral deposits in Third World countries, U.S. and European multinational corporations quickly arrive on the scene to "develop" the resources.[52]

Even Third World participation in remote sensing at a rudimentary level requires computer skills and technology that most developing countries lack. Full participation requires access to space technology. A few developing countries, like India, Brazil, and Indonesia, have become space powers, although not

necessarily in the best interests of the majority of their citizens since the elites generally seek to replicate the development path of the North. Like so many technological projects in the past, global environmental monitoring by satellite runs the risk of providing a new arena for the world's elite to dominate the poor. The remote sensing project seems to reinforce the drive to modernization that is itself the cause of global environmental change.

The Global Gaze

Global corporatization is one of the dangers of the "global view" afforded by remote sensing, which brings us to the fifth assumption. At first glance, the assumption that a global perspective is necessary appears indisputable. After all, if problems like climate change, deforestation, desertification, and ozone depletion are global in scope, then we must take a global view in order to solve them. And if these environmental problems are simply the "negative externalities" of a global economy, then a global view seems inescapable. To some extent, all of this is true, but it overlooks the dangers implicit in globalism—particularly the conceptual and pragmatic links between hegemony and globalism. In an unequal world, globalism—including global science—is all too likely to mean white, affluent men universalizing their own experiences. Global problems are amenable to large data banks, to Big Science, to grand managerial schemes. As we saw earlier, the view from space renders human beings invisible, both as agents and as victims of environmental destruction. It also erases difference, lending itself to a totalizing vision. The "global view" cannot adequately depict environmental problems because the impacts of these problems vary with class, gender, age, and race.

The very abstractness of the global view may thwart efforts to heal natural systems. Charles Rubin echoes this sentiment, suggesting that the global view removes environmental problems from the realm of immediacy where meaningful action is possible and most likely to be effective. Rubin goes so far as to reject the term "the environment" because, by essentially referring to "everything out there," it simultaneously serves to distance people from the local places where they live even as it erects an artificial totalizing structure.[53] Rubin's claim about the concept of "environment" can be equally applied to "the global view": Both seem to include just about everything except the particularism of place. Ronnie Lipschutz extends this line of reasoning, suggesting that if place is a critical constitutive element of identity, then environmental degradation is not likely to be resolved by embracing the place-eradicating "Blue Planet" image. Rather, it is in the local realm, which is laden with cultural and personal meanings, where most

women live their lives and where environmental healing is most likely to occur.[54] According to Joni Seager, the "global view" is especially problematic for women:

> The experience of women on the front lines should help us change our notion of what environmental destruction looks like: it is not big, flashy, of global proportions, or if global, it manifests locally. Environmental degradation is pretty mundane—it occurs drop by drop, tree by tree. This fact is discomfiting to big scientific and environmental organizations whose prestige depends on solving "big" problems in heroic ways.[55]

Ecofeminsts who argue for the necessity of a "subsistence perspective" on issues of environment and development echo Seager's claim that women's lives are especially entwined with the local and the organic. Their general claims about the scientific method associated with "capitalist patriarchy" could be applied to the global gaze of Earth remote sensing: "But in order to be able to do violence to Mother Nature and other sister beings on Earth, *homo scientificus* had to set himself *apart from, or rather above, nature.*"[56] While the explicit purpose of the earth remote sensing project is to rescue nature through monitoring and modeling it, ecofeminists would claim that the global gaze, by virtue of its position apart from and above nature, does violence to nature.

Managing Planet Earth

Feminist analysis suggests that the practical inspiration behind the global view is the managerial impulse, which brings us to the sixth assumption implicit in the remote sensing project. In the discourse surrounding global environmental monitoring programs like the USGCRP and the WCRP, terms like "managing the planet" and "global management" abound.[57] The "blue marble" image fosters the notion that the earth is manageable. Talk of management is so ubiquitous, and the connotation of orderly administration so seemingly innocuous, that gaining a critical perspective on it requires a great effort. Yet the matter is not particularly complex: To manage means to control, to handle, to direct, to be in charge. The remote sensing project functions simultaneously as symptom, expression, and reinforcement of modernity's dream of knowledge as power.

The drive to gain "objective" knowledge about the earth by maximizing the actual and felt distance between subject and object, I have argued above, is fundamental to androcentric modernity. The planetary gaze, relying on cameras collecting data at various wavelengths to inform us about the earth through color-coded computer simulations, is fundamentally a visual project. As ecofeminist writer Yaakov Jerome Garb shows, drawing upon feminist philosophy and the work of classicist Eric Havelock, vision has been deemed the cardinal sense in

Western thinking.[58] Of all of our senses, vision requires the least engagement; the advantage lies in separation rather than closeness. The photograph, and most especially that of the earth from space, "places the final seal on the disengagement from participation that vision allows, on the standing back so that subject views object across a void. It transforms the external world into a spectacle, a commodity, a manipulable package . . . [through] the predatory nature of the camera."[59]

The miniaturization of the earth made possible by satellite photography appeals to the managerial impulse; the "blue-and-white Christmas ornament" can be "managed" far more easily that a world of 5.5 billion people and thousands of cultures. The distinctive combination of will-to-power and the sense of the earth's fragility that typifies the remote sensing project is expressed in the words of astronaut "Buzz" Aldrin: "The earth was eventually so small I could blot it out of the universe by holding up my thumb."[60] From space, the ultimate domination of the earth, *or at least the illusion of it,* becomes possible. While it is the earth that is objectified by the planetary gaze, ultimately "managing planet earth" will mean controlling human behavior, not the earth itself. Ecosystems will respond in various ways to changes in human behavior, but they will only be vicariously "managed." It is people, even as they are rendered invisible by the planetary gaze, who will be managed. The science and technology of remote sensing perpetuate the knowledge/power nexus with respect not only to human domination of nature, but also to social control.

Thus, the six assumptions implicit in the project of global environmental monitoring by satellite turn out to be plagued with internal inconsistencies, parochial biases, and moral difficulties. Neither the science nor the technology of Earth remote sensing is neutral. The vast quantities of data generated by satellites are unlikely to lead to either scientific certainty or rational policy. Indeed, EOS technology, at least as presently constituted, seems to reinforce the drive to industrialization and the interrogatory approach to nature that lie at the heart of modernity. The global view that it purports to provide may become a totalizing perspective that omits human agency and substitutes the vantage point of a technical elite for the collective experiences of the diversity of human beings. EOS technology, like other photographic technologies, is a voyeuristic endeavor that maximizes the distance between subject and object—in this case, between the observing human and Earth's dynamic processes. Finally, the language of planetary management that pervades discussions of EOS suggests that the disciplinary power inherent in the managerial impulse is at the heart of the remote sensing project.

A Feminist Eye in the Sky?

Is the celebratory discourse surrounding the project, then, nothing more than a mask? On the positive side, even at a cost of thirty billion dollars it may be a better investment than spending the same number of dollars to send someone to Mars. Clearly there are some potential benefits in the mammoth project: Improvements are likely to be made on knowledge about crop conditions, soil moisture, forest cover, pollution levels, infestations, and climate change. Some of that knowledge will help to save lives and conserve resources. But any potential benefits of the remote sensing project are likely to be unrealized or undercut as long as the project's deeper assumptions and repurcussions are not critically assessed. If implicit in the project is the modernist equation of knowledge and power, and if it is this very equation that propels the devastation of Earth's habitability, then the gains from the planetary gaze are likely to be unevenly enjoyed and, in the long run, illusory. What are the possibilities for a feminist rehabilitation of Earth remote sensing?

An ecofeminist reading of Earth satellites, as we have seen, offers a scathing indictment of the technology's patriarchal roots and thus little hope in this direction. The gulf between the local, organic world of women subsistence farmers and the planetary gaze is simply too great to be bridged. Moreover, the strong technophobic strain that runs through much of the ecofeminist literature would seem to preclude an ecofeminist rehabilitation of Earth remote sensing. This reading, however, is unsatisfying since it tends to leave the technology in the hands of a white male managerial elite, suggesting that the use of remote sensing technology by women or disenfranchised groups represents a form of false consciousness.

Yet, while global satellite-based science has the earmarks of a mammoth technocratic enterprise, it is not immune to public opinion, nor are its fruits available only to the elite.

Remote sensing is not just Big Science; environmental groups and indigenous peoples are increasingly turning to satellite data in order to press their claims on behalf of nature and cultural survival. Perhaps most intriguing is the use of satellite data by indigenous groups for mapping their customary land rights and documenting the role of the state and multinational corporations in ecological destruction.[61] Environmental advocacy groups and indigenous peoples in Southeast Asia, the Caribbean, the Amazon, and the Pacific Northwest are attempting to integrate their traditional knowledge into modern scientific methdologies through the use of satellite-generated data and mapping software.[62]

These examples suggest that there is an alternative to viewing the earth as alien Other, as an object of knowledge and an object of control. Evelyn Fox Keller's work provides one example of the sort of reorientation that might be involved in such an alternative: Rather than positing a basic adversarial relationship between subject and object, "dynamic objectivity" draws upon the commonality between mind and nature as a resource for understanding. Keller likens dynamic objectivity to empathy, a way of knowing others that draws upon a commonality of feelings and experience in order to enhance one's understanding of another individual.[63] But if the other is to retain his integrity as other, then empathy must not degenerate into projection; the knower must maintain an awareness of her own subjective assumptions and experiences and a conception of self that is distinct yet not disconnected.

Informed by a sense of dynamic objectivity, Earth remote sensing could approach nature with a sense of empathy and respect, rather than as an object of planetary management. The global perspective afforded by satellites could honor local cultures and the needs of those whose voices are not heard in the current discourse of global environmental management. Perhaps such an orientation would make it possible for the earth to speak to us through the satellites, "to declare its subjecthood."[64] Might the view from space, along with fourteen petabytes of data and computer-simulated graphics, induce not only a state of awe—not so much of the earth itself but of human scientific and technological prowess—but also something resembling the sense of empathy that informs Keller's notion of dynamic objectivity?[65] Once the celebratory discourse surrounding satellite-based monitoring of the earth is seen for the masking mechanism that it is, and once the alienating discourse of the environment as a system to be managed is abandoned, such a possibility might be realized.

A more postmodern feminist rehabilitation of Earth-observing satellites is also possible. Keller's ideas, like those of ecofeminism, are rooted in a gender psychology of difference, although they clearly recognize the social construction of gender and are therefore less vulnerable to the charges of essentialism that have plagued ecofeminism.[66] Kathleen Ferguson's notion of "mobile subjectivities" and Donna Haraway's notion of "cyborgs" catch some of the fascinating ambiguity of indigenous peoples and environmental groups using satellite data to press their claims.[67] Here, there is no pure and unitary conception of woman to counter patriarchal modernity; nor is the line between humans and nature sharply drawn. Just as Christine Sylvester cites "the imaginative reworkings of seemingly fixed identities" in the "elephant-artist,"[68] so might Earth-remote sensing promote such identities as "ecological technician" or "indigenous multispectral analyst."

While a feminist rehabilitation of remote sensing is both intriguing and possible, we should not reject out of hand the interpretation of remote sensing as a manifestation of the will-to-power that lies at the root of humanity's crisis in its relationship with nature. This much, however, is clear. If knowledge-by-identity is to sever the knowledge/power nexus fostered by knowledge-by-distancing, then the "knowers," including the scientists, the interpreters, and the managers, will need to become conscious of the deep cultural assumptions that they bring to their knowledge. This would require a far greater interdisciplinary leap than the ones between physics, chemistry, and geology considered by Earth system science. To the extent that the social sciences are beset by the same notions of objectivity in knowledge/power nexus as the natural sciences, then what may be required is not so much an interdisciplinary leap but an *extra*disciplinary leap. An important corollary of this would be the dissolution of the gendered division of labor, whereby men think about the environment and women care about it, for dynamic objectivity would enable thinking and caring to become integrated as complementary aspects of knowledge.

Another thing is certain: If the knowers, interpreters, and actors could embrace the stance of dynamic objectivity, the hubris implicit in the knowledge/power nexus could be replaced by an attitude of humility, for humility is what follows from a feeling of kinship with the object of study. This would have major implications, not only for knowledge about the earth, but for how we should live on the earth which, after all, is why programs like the USGCRP are being established. In fact, coming to this humility may generate more practical knowledge about how to proceed in our relationship with the earth than we will gain from the fourteen petabytes of data. Perhaps then the knot of knowledge/power could be disentanged and the crucial links be made between data, knowledge, and wisdom.

Notes

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