Carrot Soup for the Mind: Carrot Growers and Ecological Rationality

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Abstract

Over the past decade, a number of factors have negatively impacted the Michigan carrot industry and carrot growers have responded to the problems in various ways. We examine growers' use of various rationalities in making decisions about adaptive strategies. We investigate the extent to which ecological rationality exists among Michigan carrot growers and influences their strategic decision making. We first elucidate the most relevant analytical lenses of rationality presented in the literature, and focus finally on several types of ecological rationality. Using material from interviews, we demonstrate that Michigan carrot growers' reliance on a practical ecological rationality provides a ground for their farming practices as well as for their overall attitudes about the farming life.

Keywords: *rationality, ecological rationality, pest management, integrated pest management, farming decisions*

Introduction

Over the past decade, a number of factors have negatively impacted the Michigan carrot industry: (1) a decline in the demand for carrots for the feeding and baiting of wild deer due to changes in policies to reduce the prevalence of bovine tuberculosis among wildlife in Michigan's northern Lower Peninsula, (2) new restrictions on chemical pesticides perceived by growers to be essential to profitable production, and (3) powerful marketing strategies of the Canadian and California carrot industries. The Michigan carrot industry has not been passive in the face of these adversities; carrot growers have attempted to react to the problems in various ways. This situation allows one to ask what decision-making strategies growers use in deciding how to adapt and respond to these changing circumstances. In exploring this question we will examine growers' use of various rationalities in making decisions about adaptive strategies. We will particularly explore the extent to which, among the several rationalities, a specifically ecological rationality can be identified and delineated.

The aim of this paper is to investigate the extent to which ecological rationality exists among Michigan carrot growers and influences their strategic decision making. In the face of formidable hardship, growers persevere with a sense of stewardship for the sustained health of their farm as well as a matter of family and local history. While certain chemical pesticides are considered to be necessary within Michigan's "pest-friendly" climate, growers would universally opt for economically feasible reduced-risk alternatives (Worosz et al. 2001). Growers routinely seek information about, and adopt, practices whose environmental benefits and efficacy have been demonstrated by University agriculture research specialists. Growers sustain the health of their soils by careful nutrient analyses, in cooperation with the MSU Extension Service and Michigan Agriculture Experiment Station researchers.

Most notably, many growers voiced strong sensitivity regarding public perceptions of chemical fertilizer and pesticide use by farmers. Often, these growers articulated resentment regarding the "environmentalist" portrayal of farm life, suggesting instead that the farmer has a strong desire to maintain ecological, as well as economic, sustainability since the farm is often expected to be passed on to the family's succeeding generations.

We first elucidate the several analytical lenses of rationality presented in the literature, and focus finally on several versions of ecological rationality that have been discussed. Using material from interviews, we demonstrate that Michigan carrot growers' reliance on a practical ecological rationality provides a ground for their farming practices as well as for their overall attitudes about the farming life. Data was collected through in-depth semi-structured interviews of Michigan carrot growers, and ethnographic content analysis was conducted.

Sociological Theories of Rationality

As social actors operate from culturally informed views (structural conditions) about what the world is and how the world should be, and at the same time assert their individual positions (agency) about what the world is and how the world

should be, the concepts of *reason*, *ideology*, and *rationality* are bound up within their actions. *Reason* is a fallacious escape from ideology because it is ideologically defined. Reason has been the ethos of western secularism since the Enlightenment and it arguably reaches back before Aristotle. *Ideology* is commonly used as a rhetorical negative. As social beings we are absolutely ideologically biased, for example, by virtue of the language(s) we are born into and adopt, or by virtue of our biophysical environment and the ways that we value particular material items. The quality of our capacity for reason reveals itself in our *rationality*, our style of rational expression.

The criteria for rational action are determined by ideological biases for rational/reasonable constructs. For example, ecologically rational action should have ecologically beneficial outcomes; but what is perceived as ecologically beneficial by one social actor may be perceived as ecologically detrimental by another social actor (Geason and Harris forthcoming). Finally, it is critical that we recognize how and when a rationality, as a style of rational expression, produces irrational outcomes. As we seek the expression of ecological rationality within the Michigan carrot industry, and specifically among the carrot growers, we begin by looking to the sociological theories of rationality to discuss where specific rationalities are useful (produce intended consequences) and where they fail us (produce unintended consequences).

Weber's Rationality Types

Weber was one of the first sociologists to address rationality thematically throughout his work. For Weber, rationality can be conceptualized in several ways. In the general overarching concept, rationality is instrumental and "anchored in means-end rational and value-rational action" (Kahlberg 1980, 1149). Weber delineated within this instrumentalism four rationality types, each with its own character. *Practical rationality* characterizes the mode of action in ordinary life wherein action is informed primarily by experiential practice. *We do it this way because it's always been done this way and because it has worked*. The accepted practice offers the most efficient means to the intended end and the practice refers back to self-interest. *I do it this way because I have found it to work best. I have something to gain or lose*. I trust my own judgement. This is differentiated from formal rationality, which is sometimes referred to as bureaucratic rationality. Essentially, the same calculative means-end practice refers instead to the given rules, standards, or regulations with the ideal of strict objectivity and universality. The processes of industrialization in the eighteenth and nineteenth centuries provided Weber with paradigmatic examples of formal rationality.

In contrast to the groundedness of practical rationality and the rigidness of formal rationality, *substantive rationality* considers the ultimate aims of actions:

> *The concept of* 'substantive rationality' *...is full of ambiguities, it conveys only one element common to all 'substantive' analyses; namely, that they do not restrict themselves to note the purely formal and (relatively) unambiguous fact that action is based on 'goal-oriented' rational calculation with the technically most adequate available methods, but apply certain criteria of ultimate ends, whether they be ethical, political, utilitarian, hedonistic, feudal, egalitarian, or whatever, and measure the results of the economic action, however formally 'rational' in the sense of correct calculation they may be, against these scales of 'value rationality' and 'substantive goal rationality.'*
>
> (Weber 1999, 214)

Substantive rationality, then, refers to the value stances of the actor. It will usually be the case that these value stances are structurally conditioned, and that something which is substantively rational can only be so in the appropriate cultural context. While shamanistic medicine, for example, would appear irrational at the scale of a western hospital as a whole, within the room of a particular patient, the practice of shamanism might be fully rational. Action and decision are rationally informed by one's relevant "value postulate ... (which) implies entire clusters of values that vary in comprehensiveness, internal consistency, and content" (Kahlberg 1980, 1155). Since the range of possible value postulates is infinite, "radical perspectivism" (cultural relativism) is a key component of substantive rationality (Kahlberg 1980, 1155). For Weber, then, rationality is both an endowment of social organization (a function of structural conditions), and a phenomenon driven by individual action (a function of human agency). The degree to which the individual act is rational can only be determined in relation to its social context. Finally, given the complexity of substantive rationality in particular, we can illustrate these rationalities as distinct from each other, but we must also consider the overlapping character of these rationalities, as Figure 1 suggests.

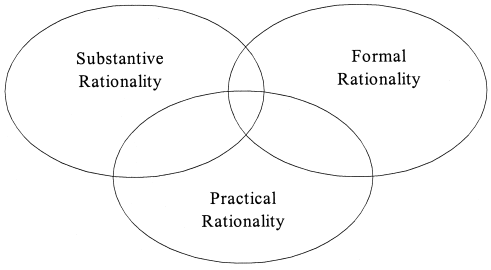

Figure 1. Weber's rationality types as directly related to action

Theoretical rationality, or intellectual rationality, relates to abstract thought and therefore only indirectly relates to action. This type emphasizes the cognitive processes involved wherein patterns of meaning are interpreted from the world. The sociological nature of this type of rationality may seem to be obscured. Again Kahlberg (1980, 1160):

> *Mental processes are of interest to Weber primarily in regard to the extent to which they can be translated into patterns of social action. In some cases, such as practical rationality, regularities of action follow so closely on the calculation in relation to self-interests that the mental process itself is scarcely visible, Theoretical rationality, on the other hand, illustrates the opposite extreme: here cognitive processes often do not introduce patterns of action.*

Further, for Weber, the rationality type may itself vary depending upon the cultural context:

> *Constellations of historical and sociological factors determine, for Weber, whether a particular type of rationality in fact found clear expression as mental process alone or as regularities of action that became established as sociocultural processes, whether at the level of groups, organizations, societies, or civilizations as a whole.*
>
> (Kahlberg 1980, 1160)

For example, it may be that for a group of academics, the activity of discussing theories is in fact a very practical activity.

Finally, a key component to rationality in general, as stated, regards the efficiency of means-end action. While rationality remains an abstract concept, efficiency is, to some degree, measurable. One may be unable to evaluate action as rational but instead one may assess efficiency of action. Weber clearly resists this reductive and narrow definition of rationality, so we turn to examine how Weber's rationalities have been further developed. This may lead one into the economic arena of the *rational actor paradigm*, which holds that humans are "rational beings motivated by self-interest and consciously evaluating alternative courses of action... (at once) conceptualiz(ing) the social universe as an aggregate of atomistic actors (and serving) as the basis of a social order that is appropriate and good" (Jaeger et al. 2000). Alternatively it may lead one into the social arena, which is analyzed by Diesing. It is to that approach that we now turn.

Diesing's Decision Rationalities

Paul Diesing elaborated the discussion arguing that a narrow, economistic rationality was being understood as rationality as a whole. To the contrary, he asserted that social behavior could not be characterized as rational with a narrow economistic view of rationality, suggesting instead that many activities are not reducible to technical efficiency. In so doing, Diesing elaborates the ways in which several common substantive orientations interrelate with instrumental rationalities.

> *A decision or action is ... rational when it takes account of the possibilities and limitations of a given situation and reorganizes it so as to produce, or increase, or preserve, some good. This definition includes two points: the decision must be an effective response to the situation in that it produces some possible good, and the effectiveness must be based on intelligent insight rather than luck.*
>
> (Diesing 1962, 3)

Diesing borrows from Mannheim (1940) to distinguish between different types of individual and organizational rationalities. "Mannheim distinguishes between *substantial* and *functional* rationality, the former applying to individual decisions and the latter to organizations" (Diesing 1962, 3, emphasis added). Social actors must often navigate decision processes alone (substantial) but functionally rational decisions take place communicatively as groups face collective decision processes.

Diesing initially criticized economism as an inappropriate frame for the rationality of social behavior. In so doing, he further extended Weber's work on rationality by outlining five distinct rationalities. Each of these distinct modes of rationality ground the decision processes in the five respective realms: technical, economic, integrative (social), judicial, and political.

Each rationality has its order. This order results from the ongoing interrelationship between materiality and ideation - between ideas and the patterned behaviors which implement those ideas:

(1) Out of necessity and survival, one, one's community, and/or one's society engages in production. Efficiency is the order of production, i.e., *technical rationality*.

(2) Out of necessity, these human systems, to a degree of effectiveness, engage in value measurement. Economic order is that of measurement and comparison of values, i.e., *economic rationality*. As Busch (2000) argues, valuation and standards are what make exchange and/or markets possible.

(3) Social order (*integrative rationality*) is an order of interdependence or solidarity, but also control.

(4) Judicial order (legal rationality) is that of a fairly distributed availability of resources — a concept usually associated with politics (e.g., Lasswell 1936). To some degree, individuals and groups coexist (perhaps with degrees of conflict) and develop the judicial sense toward fairness. As one among others in a community, one relies on others for sur-

vival and a social order develops. The complexity of that order necessitates a judicial order, i.e., *legal rationality*.

(5) Out of necessity, these human systems creatively evaluate alternative ways to approach decisions. Necessity begets the development of a rational order of decision structure. Political order (*political rationality*) is the order of discussion and decision.

We should note that the language offered here, despite its deterministic flavor, intends to emphasize the interplay between action (agency) and necessity (structural processes). Specific strategies for decision and action can be grounded in appropriate rationalities depending on the immediate as well as structural circumstances.

The question left open, then, regards environmental processes. We suggest that Diesing's model neglects the biophysical environment within which humans are immersed, as many environmental sociologists have accused sociology in general (Catton and Dunlap 1978; Dunlap and Martin 1983). Diesing's argument specifically attempted to lend credibility to decisions based on human relationships at a time when the environmental movement was a glimmer on the horizon. So, as he pointed to a social rationality in 1962 (the same year that *Silent Spring* was published), others have argued for the rationality of environmental sensitivity. Bartlett was one of the first to do so.

Ecological Rationality

Bartlett added to Diesing's framework the concept of ecological rationality: "Ecological rationality may be thought of as a rationality of living systems, an order of relationships among living systems and their environments... [ecological rationality] draws extensively from the science of ecology" (Bartlett 1986, 229). It draws on principles of holism and environmental dynamism. Time horizons tend to extend far beyond those afforded economic rationality.

Bartlett, following Simon (1976), differentiates between procedural ecological rationality and substantive ecological rationality. *Substantive ecological rationality* is grounded in the Weberian concept (substantive rationality) but it refers more simply and specifically to the capability to analyze situations in the interest of the ecosystem. "Ecological rationality may be an attribute of behavior or actions, denoting the extent to which such actions are ecologically appropriate within the limits imposed by given conditions and constraints" (substantive rationality) (Bartlett 1986, 239). *Procedural ecological rationality* refers to rational strategy for action and decision; this can refer either to individuals as with Diesing's substantive rationality or to organizations, as with Diesing's functional rationality and ultimately Weber's formal rationality. It refers to "the effectiveness, in light of human cognitive powers and limitations, of the processes and procedures used to make ecologically important choices" (procedural rationality) (Bartlett 1986, 239).

Building nicely on Diesing, then, Bartlett also hints at the prescriptive; Bartlett suggests that in certain situations ecological rationality will provide the most appropriate guide to conduct. In addition, he acknowledges human cognitive limitations in dealing with the complexity of the ecological phenomena to be brought into the equations for rational discourse. This problem may be effectively approached from the perspective of bounded rationality — born of the rational actor paradigm — as a psychological approach to examining adaptive thinking to complex situations with limited information (Gigerenzer 2002; Todd 2000). In fact the idea of bounded rationality and the resources available within one's "adaptive toolkit" serve to remind us of our reliance on historical experience — on ideological penchants. Nevertheless, Bartlett offers a useful conceptual analysis. He helps to open up a rational environmental discourse of Weberian lineage. Habermas, however, requires us to investigate the character of those ideological penchants as well as the character of environmental discourse in order to recognize the degree of its rationality.

Communicative Rationality

In contrast to Bartlett and predecessors who saw the problem as cognitive limitation, Habermas views human and social actors as ideologically limited. In Habermas' view the obstacles to rational action are not cognitive incapacity; rather, we are challenged to resolve, or at least recognize, ideological differences. In the first instance (Bartlett's view), social actors are limited by the quantity and complexity of manageable information regarding decisions in the interest of an ecosystem. In Habermas' view, social actors are limited in their ability to reconcile ideological (structural) conditions with the interest of an ecosystem. Those ideological challenges are equally present at the broadest level of advanced capitalism, as well as the micro level of rural communities: friends, loved-ones, competing growers, input salespersons, buyers, etc. In short, ideology interpenetrates all relational levels (scale) in the life-world of the grower. Each of these groups of actors brings different understandings about what works or does not work, what is right or wrong, what is important and reasonable, and each is set against the background of a society, which, as Habermas describes, places science and technological growth in the driver's seat. "The progressive 'rationalization' of society is linked to the institutionalization of scientific and technical development" (Habermas 1970, 81).

Habermas speaks, then, of a kind of perilous rationalization, which encourages ecologically irrational outcomes. Industrialization, for example, may continue to appear eco-

nomically rational, particularly given an ideological faith in the seemingly dependable development of scientific and technological solutions for ecologically harmful consequences, but is it rational to assume that such solutions will always be possible?

Looking back to Weber's substantive rationality, we oblige the local culture, as one location of the value complexes of the actor, to provide the yardstick by which to measure the rationality of the action. This measurement may coincide or conflict with the macro-cultural context (e.g., shamanism in the western hospital).

Habermas, then, emphasizes the irrationality of the scientistic and technocratic character of advanced capitalism. In so doing, he manages to tease out the rational possibilities existing where actual people communicate and act together as members of groups within or against the larger cultural setting. As he notes:

> *(A)n evolutionary trend...is taking shape under the slick domination [by] technology and science as ideology. Above all, it becomes clear against this background that two* ***concepts of rationalization*** *must be distinguished. At the level of subsystems of purposive-rational action, scientific-technical progress has already compelled the reorganization of social institutions and sectors, and necessitates it on an even larger scale than heretofore. But this process of the development of the productive forces can be potential for liberation if and only if it does not replace rationalization on another level.* ***Rationalization at the level of the institutional framework*** *can occur only in the medium of symbolic interaction itself, that is, through* ***removing restrictions on communication.***
>
> (1970, 118, emphasis in original)

Within the context of advanced capitalism wherein science and technology characterize societal ideology, ecological rationality, indicative of Weber's substantive rationality, would be irrational — actions motivated by ecological sensitivities are incommensurate with those motivated by potential economic benefits. However, broad cultural norms do reflect the decisions and actions of actual individuals, typically policy makers and power elites, but also (sometimes) the voices of active dissenters. The institutional framework requires intelligible discourse among participating players. While pessimism may rule the day for environmentalism, it can be possible, for Habermas, to shift the macro-cultural conditions of technocratic advanced capitalism into conditions wherein environmentally sensitive value complexes can hold sway.

Practical Ecological Rationality

As Bartlett builds on Diesing, Dryzek too calls for ecological rationality to be given primacy among Diesing's rationality types. In contrast to the abstract and value laden notion of substantive rationality in Weber, ecological rationality for Dryzek is very programmatic and procedural. Ecological rationality is implemented through lexical (hierarchically ordered) procedures. Institutional decisions regarding environmental matters require the strategy of ecological rationality in order to prevent "the tragedy of the commons" (for example), and lexical priority lends tangibility to such a strategy. "Lexical priority means that lower values come into play only when designs in pursuit of higher value are totally complete" (Dryzek, 1987, 59). Lexicality provides participants with a common vocabulary which becomes important when considered relative to communicative action — a key component in Dryzek's well-developed tactics for collective environmental problem solving. However, in focusing the development of ecological rationality on strategic collective decision-making, Dryzek moved it out of the realm of practical individual decision-making and into the realm of practical societal decision making.

Perhaps the most relevant (and most satisfying) discussion regarding ecological rationality is offered by Murphy (1994, 2002). Rather than appealing to Diesing, Murphy's ecological rationality draws directly from Weber. As many (e.g., Merchant 1980) have suggested, a primary consequence of the Enlightenment has been a scientistic objectification of, and alienation from, the natural world. Murphy's argument (2002, 83) outlines the consequential direct correlation between the increased technological manipulation of nature and global environmental hazards. Similarly, Beck (1994, 176) refers to "unintentional self-endangerment" of modern society — a condition which fosters anomie. For Murphy, as for Beck, this anomic response is a form of ecological irrationality.

Ecological rationality, for Murphy, consists of the reunification of the social and the material. Whereas the Enlightenment separated society from the biophysical environment, the project of ecological rationality is to provide tools for decision-making, which simultaneously accomplish both social and ecological ends. Not only do we have to accomplish both social and ecological ends but we have to recognize that they are one and the same. Ecological rationality may simply be a substantive rationality wherein value complexes regarding the social and the material are integrated. Further, ecological rationality, in keeping with Bartlett's suggestion, accomplishes this integration by expanding our temporal scale far into the future.

In a sense, the extended range of ecological rationality is a perceptual shift. What have been otherwise lofty idealizations — the benefit of future generations, the well being of the natural environment and wildlife, etc. — become very tangible concerns as the risks become tangible. Ecological rationality becomes a matter of practice, of practical action. Here, we reintroduce the term *practical* only partly in reference to Weberian rationality. If Weberian practical rationality refers (for the actor) back to personal interest, experience, and benefit, and substantive rationality refers to the value complexes so culturally embedded in the actor's world, then practical ecological rationality binds together both the tangible consequences the actor anticipates for her/himself and the impacts s/he anticipates for the biophysical environment.

Ecological Rationality — A New Synthesis

In light of the theoretical outline of types of rationalities, we offer several conceptual issues which ecological rationality can address for us. The term *substantive* entered our discussion in two specific ways. For Weber, substantive referred to the value postulates of a given cultural setting. The rationality of actions must be evaluated in terms of its consistency with the value complexes of the setting. For Bartlett, substantive indicates, in a sense, the motivational component of rational action as he differentiated substantive from procedural, the rational strategy to be implemented. Certainly, Bartlett's conception is consonant with that of Weber. We will stay with a conceptual understanding of substantive rationality, but to emphasize the motivational aspect we will use the term *generative*. A generative rationality can motivate action; actions can be evaluated to identify the generative rationality of that cultural context. While this concept leans toward the structural, and seems to suggest that actions are motivated merely by cultural conditions, we do not intend to suggest that actions are strictly the consequence of structural conditions. In fact, such a suggestion would entirely negate the notion of rationality, which implies the degree of alignment between one's actions and one's societal value complexes. Social actors, with some degree of rationality, affect outcomes through action.

The second component of ecological rationality that we wish to emphasize we will label *procedural*. Bartlett, as stated, specifically differentiated the procedural from the substantive (generative). Generatively, one is ecologically rational in terms of one's motivations, and procedurally, one is ecologically rational in terms of one's actions. While Bartlett offers little in the way of specific strategies, Habermas and Dryzek, on the other hand, offer more specific approaches. While Habermas calls for careful attention to the mode of communication in order to create intelligible discourse without the trappings of actors' ideological biases, and therefore enable collective rational action, Dryzek offers lexicality as a means of prioritizing issues — a checklist of communicative action.

Outcome, in the most common sense usage, suggests the consequence of action. Whether intended or unintended, consequences result from the act (procedure), which may or may not be generatively intended. We must emphasize caution regarding our usage of outcome. With Murphy squarely in mind we maintain that material (bio-ecological) outcomes are inextricable from the outcome as social experience. If one understands outcome merely as produced material things — an automobile as an outcome of economic rationality — it would follow that we absurdly suggest such things to be, to some degree, endowed with rationality. Rather, the carrot field (for example), as a functioning ecosystem, is a tangible characteristic of rational expression. Therefore, outcome ecological rationality is a manifestation of socio-bio-physical consequence.

Thematic throughout this paper, though often only through implication, we have touched on the issue of *scale*. Rationality as a concept is equally relevant as a macro-systemic phenomenon as it is relevant at the micro level. Weber emphasizes both the value complexes inherent in particular cultural settings and the individual's choice to act in accordance with or against such conditions

Habermas, as well, articulated rationality as the function of society — as he spoke of advanced capitalism — yet rationality is equally a function of personal interaction. For both, the degree to which actions are rational (or irrational) can be assessed only by examining the action within or against its cultural conditions. Murphy, then, adds materiality. We act with some degree of consistency to our cultural conditions, and our various cultural settings inform and motivate our actions, all the while our actions are fundamentally contingent upon the biophysical environment.

Our actions take place in biophysical space, shaping, transforming, preserving, or in other ways affecting material stuff. That stuff, therefore, is central to our cultural value complexes, to our motivations for action, hence to actions themselves, and the outcomes of those actions. Figure 2 illustrates the paths from these theorists to the concepts offered here. We turn then to the question of the ways in which Michigan carrot farmers use practical ecological rationality in deciding on adaptive strategies for their farming operations.

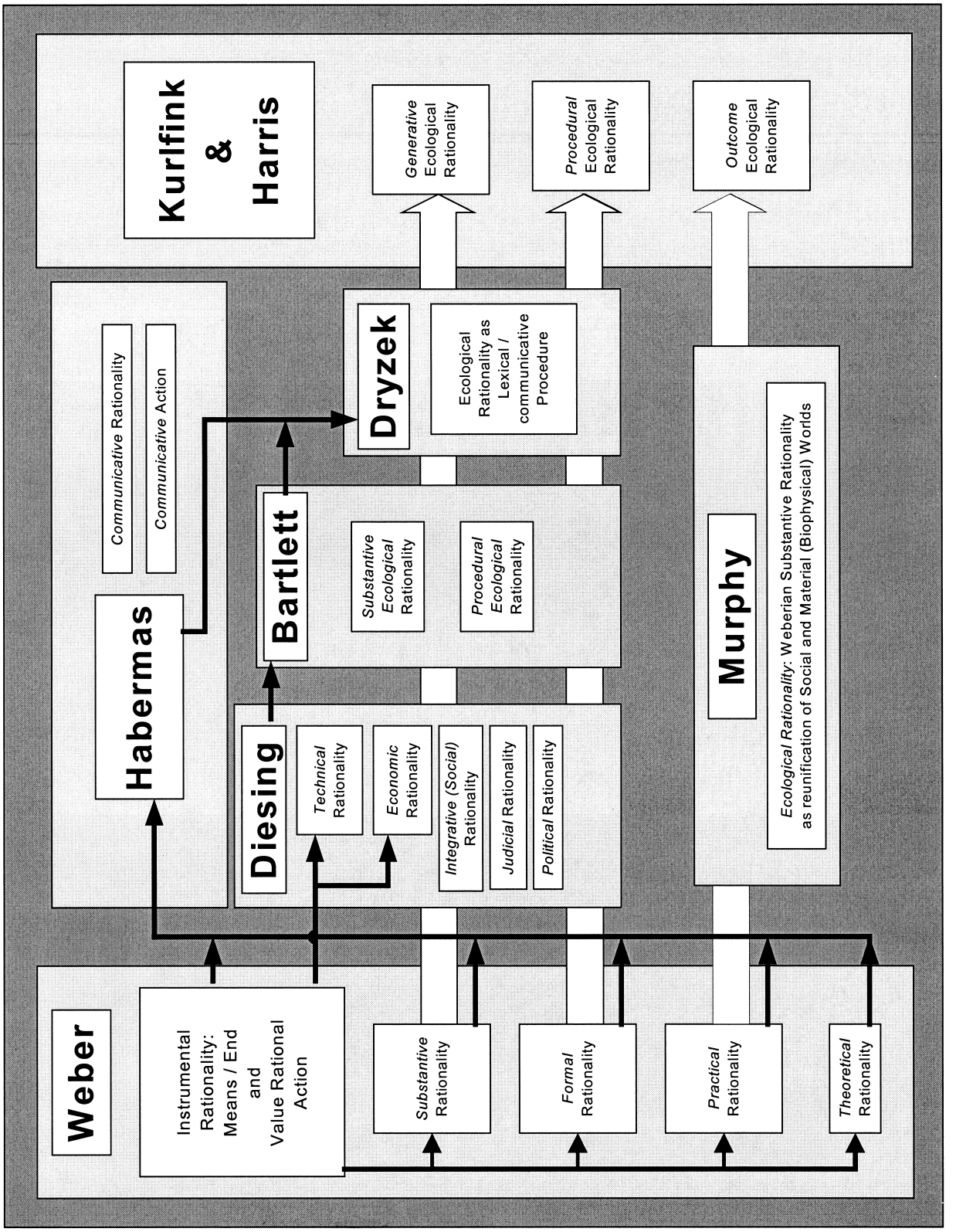

Figure 2. Sociological Theories of Rationality

Methods

In order to better understand the ways that Michigan carrot farmers make decisions regarding the specific problems they, and the industry, face, we undertook a series of semi-structured in-depth interviews. The interviews lasted between one and one-half to two and one-half hours and revolved around issues such as the changing challenges within the industry, general farm management practices, and decision-making. More specific topics were covered such as the reduced deer-feed market, changes in pesticide availability and pest management practice, overall changes in the market, satisfaction with current pest management techniques, and ideal future pest-management strategies. We also discussed general carrot industry questions regarding, for example, market conditions, consumer demand regarding carrot quality and appearance. We inquired about family and farm history. Overall, the range of questions was intended to create an overview of how growers viewed themselves within the Michigan carrot industry during a time in which market conditions and environmental regulations were in flux.

We conducted individual interviews with sixteen growers and processors. Interview transcriptions were analyzed using the Nudist Vivo qualitative analysis package to identify major themes concerning adaptation to adversity and decision-making in the face of political, economic, and biological pressures.

Results and Findings

Types of Practical Ecological Rationality

In light of the literature on ecological rationality outlined above, and through ethnographic content analysis of our ongoing conversations with the Michigan carrot growers, we identified three types of practical ecological rationality within several topic areas: pest management practices, organic production, interest in information regarding current agricultural research, land stewardship, and the tensions between productivist agriculture and environmentalism. It is through these specific topic areas where the three rubrics, or types, of ecological rationality were articulated by the Michigan carrot farmers. First, we identify what we call the *generative* or motivating function. This is the causal character of ecological rationality, leading one toward what one intends to be ecologically beneficial actions/decisions. This is the explicit, deliberate intention to accomplish ecologically sensitive action.

Secondly, we identify the *procedural* component. When faced with a decision, some growers will follow a standard operating procedure. Procedures may be developed on the basis of long-term, perhaps even multi-generational, experience, or procedures may be based on various sources of external advice (e.g., chemical company representative, extension agent).

Regarding the third component, *outcome*, we reiterate the caution stated above. While our conceptualization does not resolve the problem of equating rational processes of mind with external events and things, we nevertheless view outcome as a practical expression of socio-bio-physical consequence. Outcome is the realization of the ecologically rational act. The ecologically beneficial outcome may not necessarily have resulted from deliberately ecologically rational motivations or explicit strategies but it represents ecological rationality if, in fact, it is ecologically beneficial. The actor may perceive ecologically beneficial outcomes, or the outcomes may go totally unrecognized. If the outcome is not seen as a consequence of one's action, one has the situation described by cognitive anthropologists as emic models (Rappaport 1984; Dryzek 1987).

These three components of ecological rationality are only partially integrated as the Figure 3 illustrates. It is possible for a grower's behavior to be purely generative, purely procedural or purely outcome oriented. But perhaps more interesting sociologically are the questions of the extent to which and the ways in which the three components are integrated. How does the generative component influence farm operation procedures? What monitoring is done of the outcomes of carrot raising procedures? How do perceived outcomes feed back into the generative function — can outcomes drive future ecologically rational action? If so, an outcome may be understood as a consequence of the grower's actions and valued as ecologically important, and may come to drive future ecologically rational action. Finally, we note the strong resonance between the ecological rationality types and those rationality types Weber described as directly related to action as illustrated below. Generative ecological rationality is strongly rooted in Weberian substantive rationality as they share the contextual component. Weberian formal rationality provides the rules and standards by which procedures are followed and Weberian practical rationality shows us what works to our own ends. Outcomes, in a practical sense, speak for themselves.

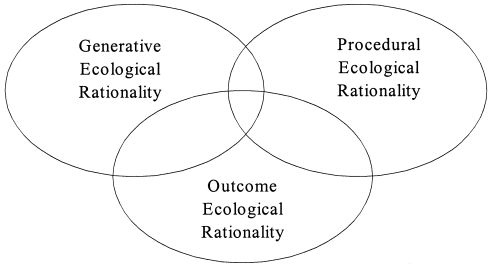

Figure 3. Types of ecological rationality

Each of the three forms of rationality was expressed in several contexts. Since the interviews were loosely structured around a number of discussion topics, each of the following examples emerged relative to those topic areas. Examples of each type of ecological rationality, therefore, are described with respect to the topic areas. Topic areas include (1) stewardship, (2) micro/macro level rationality, (3) recognition of environmental harms, (4) organic production, (5) pest management practices, (6) land-grant agricultural research, and (7) tensions between productivist agriculture and environmentalism.

At this point, then, we offer discussion and examples of the three types of ecological rationality.

Generative Ecological Rationality

There were many instances in which growers articulated forms of generative ecological rationality, illustrating their motivations and intentions for environmentally sensitive action. With regard to stewardship, one grower discussed his own visceral discomfort when he sees evidence of poor soil management:

> *You get a windstorm around here in the spring, the sands blowing, (and) I'd like to go bury myself in the basement... 'cause I don't want to watch it. It's sickening...I mean, you can see plumes going up in the air.*

Certainly, this grower offers an ideological expression of an environmentally sensitive behavior, both as he carries it, and as he experiences it among the growers in his region.

Another grower expressed his sensitivity differently, and while this example is relevant to *stewardship* it also grows out of the theme regarding *micro/macro level rationality*. His is a pragmatic interest in stewardship, both in terms of the production of food and the stability of American agriculture (macro level), and as steward for the wildlife with whom he, in a personal sense (micro-level), cohabits:

> *If we can go to the moon and build a space lab, I guess it's time to work on our food program, and work on taking care of our wildlife. We're not here to turn our back on them. They're here for us to take care of.*

This grower, within a single sentence, juxtaposes two positions that he feels may be irreconcilable. He offers a moral position about how growers should behave. Yet he says as much about good grower behavior as he says about an agro-industrial production system that constrains such behavior. He places responsibility on consumers to care about how and where carrots (and all American food items) are produced suggesting that consumerism jeopardizes the rural landscape and lifestyle. This grower suggests that to assume responsibility as steward of land and wildlife (micro-level rationality) is irrational in the context of macro-cultural conditions (macro-level rationality) whose obstacles to ecological rationality are agro-industrial production and consumerism.

Also relevant to *micro/macro level rationality*, another grower suggested that ecological rationality (not his choice of words) is shared by some groups of carrot growers as a cultural collectivity. His perception of the ecological sensitivities of the growers in his county, one of the major carrot producing counties in the state, was that he and many of the other county carrot producers are more concerned with the ecological well being of the region than are growers in other regions:

> *We're more concerned; this area is very concerned about it. I don't know why that is. It's just the way agriculture happened in this area and it's part of the crops we grow, too. When you go outside of this area... we're...more concerned about it than other growers... I think we are more concerned about it than others, outside the area.*

This example also illustrates the ways in which some growers manifest a generative ecological rationality through the recognition of environmental harms that are caused by some carrot production practices. Many members of this particular group of growers communicate and encourage ecological sensitivities.

Concerning, then, the *recognition of environmental harms*, one grower discusses the Michigan agricultural technique of decades past in which wetlands were drained and converted into very fertile muck fields. He expresses concern for the negative environmental consequences resulting from the disappearance of wetlands:

> *It's a filter. Muck that has not been (drained), is swampland. Swampland doesn't drain really fast. You take all this water that runs off this open farm ground and runs into this muck area, it really gets filtered before it gets into the streams. I think it makes a big difference.*

We can debate the accuracy of his statement, a debate that becomes relevant to the ecological rationality of the strategies he employs, and the ecological rationality of the outcomes of that procedural rationality. At this point, however, it serves as a sound example of generative ecological rationality by illustrating genuine concern for environmental matters.

Another important topic area regards grower perceptions about *organic production* in the Michigan carrot industry. We

were interested in how they characterize organic production and what the barriers might be for their own transition to organic production if they were interested in making such a transition. Ecological rationality emerged in interesting ways through this topic.

The issue of organics is perceived to be unrealizable as a sustainable practice with current techniques. This grower is open to organic production but feels that current techniques would be harmful. Generative ecological rationality regarding organic carrot production in Michigan, for this grower, rejects chemical free practices for IPM (Integrated Pest Management) — a presumably sustainable alternative:

> *I was on an organic farm in Colorado two years ago and they grew at that time, I think it was around 300 acres, maybe more, 500 acres of organic carrots. You know, there's a lot of talk out there about organic but what I seen in Colorado, they were organic but they're weren't sustainable. I mean, that soil, what I seen there and it was windy but they said it was windy there all the time, I seen plumes in the air that were 300 feet tall from dust blowing and dirt blowing away in these fields when I was there.*

This example illustrates how the grower thinks about organic production relative to his own practices and therefore illustrates generative ecological rationality. He reflects on his feelings evoked by evidence of poor (ecologically detrimental) farm management practices.

Procedural Ecological Rationality

One of the primary foci of the research has been to better understand the ways that growers make pest management decisions and how they think about available alternatives. Ecological rationality, then, becomes evident in grower desires to limit chemical inputs to the minimum effective application. Certainly, they quickly offer the obvious benefit. Less input saves money as the products become increasingly expensive. Nevertheless, the growers often move right into the "more important" benefits of chemical input reduction.

Regarding *pest management practices*, the following examples reflect the ecologically rational strategies regarding specific pest management procedures. In particular, there is a great deal of concern for effective soil management and the minimization of chemical inputs into the soil. While discussing these issues, several growers offered their strategies for reducing inputs into the soil for the sake of soil health. As one grower stated:

> *I haul water to wherever I'm spraying and I fill up in several spots... If it's really concentrated in one spot, that spot will never be alive again, just never.*

Another grower spoke of his method of "banding" rather than "broadcast" spraying as a means to limit the chemical inputs into the soil between the rows of carrots:

> *We got sprayers, banders we rigged up to go behind you. We've got a five foot wide row, you're spraying a 12 inch wide strip, your concentration is the same on that 12 inch wide but guess what, on a broadcast spray, it's 150 product per acre. Instead of putting a 1/4 [ratio] on 'em, we'll put 1/5 [ratio] on 'em on a broadcast basis and we're getting the job done... at that much of a reduced rate.*

Certainly, there are economic incentives for these practices. It would be foolish to suggest the absence of economic rationality within these examples. However, they serve as useful examples of the procedural component of ecological rationality as they were described primarily as methods for managing soil health. Economic rationality would apply when good soil health were merely a means to the economic gains of maximizing yield. Certainly, this is not overlooked as a desired outcome, but here the grower is concerned with healthy soil as the primary desired end.

One area of discussion regarded the degree to which the growers read and follow the suggestions of *land-grant agricultural research* offered through extension services from Michigan State University. Certainly, their willingness to participate in these interviews suggests a more general openness to university research. It seems that such an interest may be motivated in a variety of ways. While there may be economic benefits which result from the ongoing research, there may be perceived environmental benefits as well. In our discussions regarding these kinds of benefits, the following examples surfaced.

The "Tom-cast" crop disease-forecasting device is a product currently being tested in cooperative research with a number of growers and Michigan State University researchers. The following example illustrates the procedural component of ecological rationality relative to the implementation of Tom-cast as a method for reducing pesticide applications:

> *Our program with the Michigan State consultants, they monitor the sensors once a week and they come and give us a printout of the leaf wetness numbers and then we base our sprays off that, they do it on a Tuesday and then kind of project when to spray. With asparagus we've used 15 for a trigger point but I guess in all reality it's new enough in the carrots we don't know what that trigger point is gonna be, if it's gonna be 15 or 20. You know, if you break it in the center and do 17 or something, you know, we need a couple of years to fine-tune it.*

This example, then, illustrates strategy. This is something the grower is currently trying and therefore procedural ecological rationality is exemplified.

Indicative of procedural ecological rationality through a sense of environmental responsibility and *land stewardship*, one grower spoke of his plans to remove an underground gasoline tank despite the considerable cost of removal:

> *I'm probably gonna pull a gas tank out of the ground this year just because I'm afraid of, well, I watched it put in and it was covered with tar. It was a certified tank. If it had any scratches they sent you another thing of tar to cover the scratches before you covered it up... I doubt that it's leaking. It's been there for probably 15 years.*

This grower reveals his environmental sensitivity and sense of responsibility in a very direct way through this description of his intended procedure.

Many of the growers spoke candidly about their discomfort regarding their perception of an adversarial relationship with "environmentalism." Environmental groups are perceived to be targeting agriculture as the cause of environmental degradation. Specifically, growers perceive a "public perception of growers" to be one of careless abusers of chemical pesticides. In fact, most voiced the suggestion that growers have more interest in careful pest management and the sustainability of their land than does anyone else. For this reason there is considerable resentment toward environmental groups in general. Through discussion of the topic of *tensions between agriculture and environmentalism*, ecological rationality revealed itself and we offer the following examples.

This grower discusses the quantity of chemical inputs he perceives the EPA to expect him to apply versus the quantity of pesticides he actually does apply:

> *Well, go to the EPA, they go to the, they go to a spray book, you know, and somethin' like this, look through it. Oh, Bravo, okay. Every 5 days or every 7 days or every 10 days, these guys are puttin' on the equivalent of a pound and a half of Bravo for eight weeks, 10 weeks. Holy cow. That's 15, 20 pounds of Bravo. That's not what we do. I've got one, two, three, three Bravo sprays on there all summer long on carrots.*

The procedural component of ecological rationality is expressed through his actual strategy of chemical application relative to those he perceives to be EPA expectations.

Recalling the example regarding *organic production* under the generative category, we illustrate the connection between types of ecological rationality. The grower moves from feelings evoked by perceived detrimental practices (generative ecological rationality) to the relationship between those feelings and his own resulting practices. Here, the grower refers back to an experience on a Colorado organic carrot farm:

> *I seen plumes in the air that were 300 feet tall from dust blowing and dirt blowing away in these fields when I was there. They have no cover crop 'cause they don't know how to control 'em. They don't, you know, how do we control a cover crop in the spring? You know, you either do it with chemicals or you do it with tillage. Their comment to us when we asked 'em about it, they said we have no good way to control our cover crop so we don't plant cover crop.*

Cover crops are perceived to be a very important component in maintaining topsoil and managing soil erosion. This grower plants a winter wheat cover on his fields after harvest to manage soil erosion. This is tilled under prior to planting. Of greater interest here is the practice of planting rye between rows of carrots to protect seedlings from soil and wind damage. When the carrot leaves grow to approximately nine inches the rye must be removed for the carrot to thrive. Tillage is not an option for this cover crop, as it would damage the carrots, so an herbicide is used to remove the rye. Organic production, would be ecologically less rational than chemical application because the cover crop with chemical inputs is perceived to be more sustainable than no cover crop, no chemical inputs, and increased soil erosion. Further on, we will again return to this example as we illustrate outcome ecological rationality, and as one example where each of the three types of ecological rationality occasion the others.

Outcome Ecological Rationality

The outcome component is exemplified by the processes which have proved themselves. In the following example which concerns *pest management practices*, the grower notes the effectiveness of scouting, the practice of walking through the field and visually scanning for insect, disease, and weed pests, and Tom-cast. These practices help growers spray chemical pesticides only "as needed" rather than the customary timed sprays:

> *Well, scouting is working very well. I mean, the scouting tied in with the Tom-cast. You know, you tie that all together... I talk to other growers in the state that don't use any of this and...they're goin' way overboard of what they need to do.*

This example serves to illustrate how the outcome informs the generative. The process proves effective through outcome and motivates continued practice.

Regarding the use of "Tom-cast", relative to *land-grant agricultural research*, one grower has settled on a higher than recommended humidity reading which enables him to wait slightly longer than recommended between applications:

> *Well, I don't have it (Tom-cast) on this farm but there's several within a quarter mile, really important I think, but I also have my own theory. They say spray at, say they say spray at 15 points. I'm gonna go to 18 and I don't see worse results.*

The process has proven itself for him and offers an illustration of the outcome component of ecological rationality.

Regarding both *land stewardship* and *organic production*, we return to the grower whose soil management practices via cover crops create a practice perceived to be more sustainable than organic practice. Further into the discussion regarding cover crops and the perceived negatives associated with organic practices, he pointed to the field across the road from his shop. It was early spring and the field was green with winter wheat. Cast against organic production, his practices result in what he perceives to be truly ecological outcomes as a matter of his responsibility to the sustainability of his land. The use of cover crops throughout the year help to reduce soil erosion. As earlier mentioned, cover crops also protect newly emerging carrot leaves from wind damage:

> *In this area, cover crops, like right across the road, that field is green now. Most areas, agriculture areas you go into do not do that. They can't deal with it. We can deal with it here so it's accepted here. We don't go through one year, I mean, when our crop comes off it gets a cover crop put in and it's growing through the winter. It's green. It will be plowed down in the spring. But it protects that soil out there, you know, over the winter, over the snowbelt, over the wind erosion that can take place. I got more ...wind erosion from this ditch I got dug out from my house than I got in 40 acres out here.*

Out of a deliberate sense of stewardship, this grower illustrates the outcome component of ecological rationality as soil and wind erosion is, and has been, managed via the use of cover crops.

Further, regarding *organic production*, the following grower, like the previously cited grower, has not adopted fully organic production practices. He has, however, adopted some of the practices, has found them to work, and they have become part of the overall practice. Therefore, they represent the outcome component of ecological rationality:

> *We're starting to deal more with organic fertilizers now instead of a straight fertilizer. You know, we're using compost and both my brother and I think we're seeing a result from it but we don't know that for a fact but we, I just, I got to believe it's better for the soil. So we're gonna continue playing with it.*

This quote serves as another example of the outcome feeding back into generative and procedural functions of ecological rationality. "We're seeing a result" implies outcome. "I've just got to believe it's better for the soil," suggests generative rationality. "We're gonna continue playing with it" points to the strategy.

Conclusion

A central theme in environmental sociology is the relationship between human and social dimensions, on one hand, and environmental and ecosystemic dimensions, on the other (Goldman and Schurman 2000). A central theme in agricultural sociology is change and stasis in farm management practices (Buttel et al. 1990; Fleigel and Zuiches 1993). Ecological rationality is broadly relevant to both of these concerns.

Also of particular relevance to sociological inquiry is the indivisibility of structure and agency. This indivisibility manifests itself both in the ideological realm and in the sphere of action. Thus, what strikes us when we look over the types of ecological rationality is the ways in which the agency/structure dynamism emerges out of our conversations with the growers.

So as we begin to understand the ecological rationality of Michigan carrot growers, we must ask about the practical relevance to the Michigan carrot industry — a central point which has yet to be fleshed out. We must now look to the character of rationality at the structural level — carrot growing and the carrot commodity system — so that we better understand ecological rationality across scale dimensions.

Further, what we have yet to do effectively is clarify ecological rationality across the time dimension, and chart it more explicitly through from the generative, the procedural, as outcome - as a dynamic interaction among the three types. The examples regarding organic practice serve only to begin this discussion. In Michigan, there are no growers "within the industry" growing organically. As we identify growers "in the fringes" we can understand both dimensions more comprehensively. We then ask if "organic" practice is ecologically rational in the Michigan carrot industry. And if not now, can it become rational? Ultimately, is the trajectory (across time) of carrot production in Michigan (across scale) an ecologically rational process? The theories outlined may allow us to conjecture about the scientistic and technological leanings of agro-industry in general. Yet the absence of clear empirical

description of ecological rationality as the societal and historical contexts against which to evaluate the ecological rationality of the growers provides us with exciting possibilities for future investigation.

Endnote

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