Predicting Gastronomy? Exploring Ecological Models and Food-System Dynamics

David Szanto (9553002)
SPEC 832B: Ecology for Environmentalists

April 29, 2011

INTRODUCTION

As both ecological and food crises mount—sometimes in strong relationship to each other—the future of human and planetary health seems dire. Although science, policy, and social action are gradually coming to recognize that the arbitrary and dualistic divide between humanity and nature simply does not exist, false dichotomies persist. Ecology, as the study of the relationships between organisms and their environment, demonstrates that the "environment" is composed of the very organisms that are in interaction with it, as well as the abiotic aspects of landscape and sea. So too does the realm of food comprise of a set of organisms—including one very dominant predatory species—whose dynamics partially constitute the environment(s) around them. Just as humans and nature cannot be seen as mutually exclusive, neither can humans and food, nor food and culture.

At the beginning of the nineteenth century, the term *gastronomy* was constructed from the Ancient Greek words for "stomach" and "written law" (*gaster* and *nomos*), etymologically giving it the meaning "the rules that govern the stomach." Early writers on the subject largely construed gastronomy to encompass the taste, pleasure, and etiquette of dining—that is, a focus on aesthetics and organoleptics.[1] In 2011, the populist websites Wikipedia and Wiktionary respectively define gastronomy as "the art and science of good eating"[2] and "the study of the relationship between food and culture,"[3] requiring further clarification of the nebulous notions of "good" and "culture." Demonstrating a more complex understanding of food, including an acknowledgment of the industrial, informational, and green revolutions that have taken place over the last two centuries, today's leading food scholars have expanded the meaning of gastronomy to include a breadth of food-related activities, as well as a necessary politico-ethical articulation. Barbara Santich, a food historian and the former director of the University of Adelaide's Master of Gastronomy program, includes "the production of food, and the means by which foods are produced; the political economy of food; the treatment of foods, their storage and transport and processing; their preparation and cooking; meals and manners; the chemistry of food, digestion, and the physiological effects of food; food choices and customs and

[1] Brillat-Savarin; Grimod de la Reynière
[2] http://en.wikipedia.org/wiki/Gastronomy, referenced 4/25/11.
[3] http://en.wiktionary.org/wiki/gastronomy, referenced 4/25/11.

traditions,"[4] while the University of Gastronomic Sciences' founding dean, Alberto Capatti, calls gastronomy "a profession, a reason to act, a process of refining the senses, a way to study the earth and probe why products have appeal."[5] Clearly, then, gastronomy should be understood as a system of other systems—food production, processing, distribution, communications, sales, preparation, and consumption—which occupies a space that involves the natural environment, the social environment, the technological environment, and an environment of measurement and discourse. It is neither a single discipline nor a single area of practice, and while it comprises many different fields, no one activity within a given food-related field can by itself be considered representative of gastronomy. Rather, gastronomy concerns itself with relationships and connections—the complex dynamics of food, people, and environments. At varying scales within this metasystem, therefore, we need to examine different kinds of interactions, both between individual actors as well as between larger communities.

In the processes of food production, plants, animals, and humans interact, strongly influenced by the vicissitudes of climate and other natural phenomena. Political and economic entities also play roles, both through the imposition of regulation and the extraction of value. The same can be said of ecological production. Whether a species reproduces and survives, migrates and colonizes, thrives or goes extinct is dependent both on processes that are endogenous to plant and animal life cycles, as well as the politico-economic effect that humans exert. Food and the biogeophysical environment are therefore unquestionably intertwined, and while an attempt to disentangle them is not necessarily relevant here, taking an ecological perspective on food may provide insight into the interactions at play within food production and consumption, as well as the dynamics that can lead to food-system breakdowns and/or crises. Ultimately, this may help understand how to mitigate some of the more damaging food breakdowns that take place both locally and across larger scales, similar to the ways in which some forms of ecological degradation have been slowed or reversed in recent years.

Over the past hundred years or so, gastronomic practices have had an ever-increasing impact on ecology, and the results have been well documented. On land, habitat modification or outright destruction has dramatically changed plant and animal population dynamics, while the vast quantities of nitrogen and phosphorous that have been introduced into ecosystems as

[4] Santich, 1–2.
[5] Capatti, 9.

run-off from contemporary industrial farming practices have triggered numerous unexpected effects. Pesticide, fungicide, and herbicide residues are yet other externalities from farming, with their own influences on individual and community health. In the oceans, the impact is equally dramatic, if not more so. Plummeting fish populations and the cascading effects they induce, as well as genetic pollution from pisciculture enterprises, are just two of the more notable results of our oceanic food-system activities.

Taken from the reverse perspective, ecological forces have their own impact on gastronomy. As species disappear or emerge, food tastes and activist groups respond. When large-scale disturbances occur—drought, tsunami, pestilence—food production is affected. For the most part, such disturbances have a local effect; more pandemic or longer-duration events have caused wider global shifts, however, in availability, prices, and public perception.

Given this gastronomic-ecologic entwining, it becomes relevant to view the two systems as not only intersubjectively linked, but as possessing, potentially, similar behavioral dynamics. An examination of these dynamics may illuminate internal structures that can be used to better understand current food-system patterns, as well as whether there is value in using ecological models to predict or bring visibility to gastronomic behaviors.

In this paper, therefore, I examine three models drawn from ecological theory, taken at three different scales: a four-level trophic model, considering the interactions of a community of competitors, predators, and prey; a metapopulation model, looking at migrational and redundancy relationships; and a panarchy model, involving the dynamics of complex adaptive systems. To probe the efficacy of these models in understanding gastronomy, I use elements from the life histories of two socio-economic realities of food, namely the Whole Foods Market supermarket chain (a high-end, quasi-sustainable retailer) and Slow Food International (a self-contradictory, multi-faceted non-profit organization founded in Italy). Both entities demonstrate a variety of behaviors and degrees of success, which vary both geographically and temporally. Specifically, I look at the marketing-communications efforts they direct at consumers, aspects of their operational structures, and the community of similar "species" within which they reside, as well as the levels of consumer response that have allowed them to expand, restricted their growth, or required shifts in character in order to succeed in new locations.

Starting with the trophic model, I cast commercial food marketers and non-profit or activist organizations as predators that prey on the attention, energy, and ultimately dollars of individual people. The more strongly competitive commercial messagers (such as Whole Foods)

face pressure from above—government regulation—while the weaker guild members (such as Slow Food) are less affected. Moving on to the metapopulation model, I explore how migration—figurative or actual—may affect species dynamics, and explain some of the observed discontinuities of food-world behavior. Finally, I interrogate the theory of panarchy as put forward by ecologist C. S. Holling and his associates, in order to examine the nature of "complex adaptive systems," which include both ecology and gastronomy, but also such arbitrarily delimited systems as society, economy, and politics. Though conceptual in many ways, these latter systems nonetheless have tangible effects on the material world, including food.

THE TROPHIC MODEL

Numerous models incorporating predation and competition activities have been explored in market and business settings, including how controls on predation through regulation as well as different limits on competition can have a range of effects on market health and consumer welfare.[6] Here, I consider a relatively simple model of four trophic levels, set in the milieu of food-consumption marketing messaging aimed at the consumer (see Figure 1). These four levels include government regulators (secondary consumers), commercial food marketers and non-profit or activist organizations (primary consumers), and individual people (primary producers). These last require their own sustenance—food and shelter, rest and social connectivity, leisure—paralleling sunlight, micronutrients, and water in the ecological model.

Food marketers and non-profit organizations prey on individuals' time and purchasing power, as well as attention or mental energy, to a certain extent. The predatory act takes the form of messaging dispersal—a baiting process—followed by the individual either escaping (ignoring the message) or succumbing (making a purchase). Further up the chain, government regulators also feed on time and dollars, extracted from commercial food marketers through the labor and attention required for abiding by regulatory practices, as well as through taxes on operating revenue. Non-profit or activist organizations are less subject to predation, due to lower or non-existent revenue potential. In this model, primary producers are also subject to some predation from the top-level predator, though to a much lesser degree.

This model applies to only a small slice of the overall food consumption web—that of communications messaging and individuals' responses only. (Greater complexity is introduced

[6] Farrell & Katz, Faure-Grimaud, Tsing.

in subsequent discussion of the two other models.) It predicts that increased activity by primary consumers (in the form of messaging) will put pressure on primary producers (to purchase), who in turn will draw on their sources of sustenance to maintain overall population strength. It also suggests that the stronger competitor in the predator guild (commercial marketers) will dominate in the "consumption" of producers, potentially driving the weaker competitor (non-profits) to extinction, or forcing them to shift their consumption behavior to exploit another species. Further up the trophic chain, pressure from secondary consumers (regulators) on primary consumers should give some relief to primary producers. The small degree of direct pressure from secondary consumers on producers is negligible.

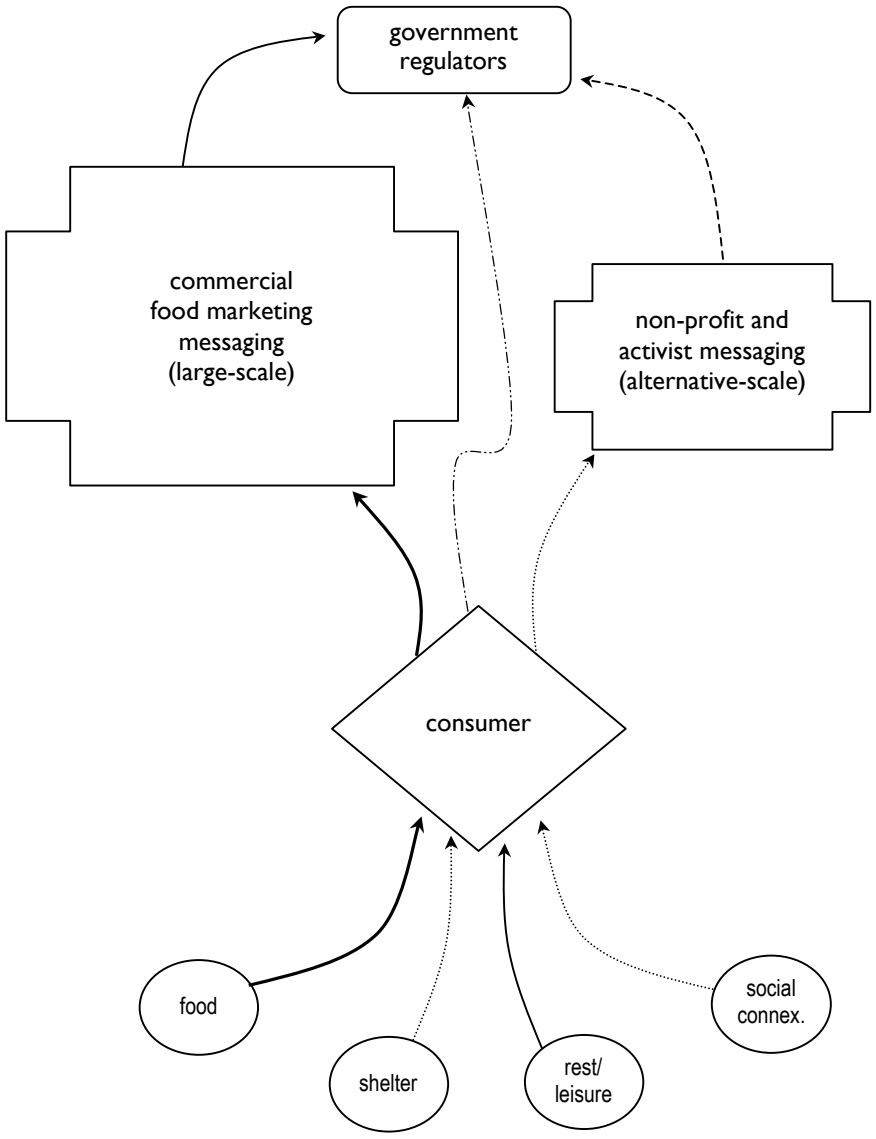

Figure 1: Flow of time and money during predation through food messaging. The figure represents an assemblage of actors in the system, rather than a true portrait of the "food-consumption web," since several variables are excluded. Commercial food marketing messaging may originate from supermarkets, national or local advertisers (producers of brand-name food products), restaurants and celebrity chefs, and food media outlets that generate original content (versus news or reporting media). Non-profit or activist messaging may originate from groups such as Équiterre and Slow Food, food cooperatives, CSAs, volunteer organizations, individual farmers, celebrity food writers such as Michael Pollan or Wendell Berry, and food documentaries such as *Food, Inc.* or *King Corn*. To a lesser degree, the communications arms of government regulators may participate in consumer-level messaging, either directly (including in schools) or indirectly through medical organizations or news media.

How does this play out in gastronomy, then? Both Whole Foods Market (WFM) and Slow Food International (SFI) create and transmit marketing-communications efforts directed at food consumers.[7] The former, a retail organization founded in 1980 and headquartered in Austin, Texas, operates more than 300 stores in North America and the U.K. (12 of which are located outside of the United States).[8] Food scholar Josée Johnston has asserted that WFM is "oriented towards customer concerns of health and environmental sustainability," citing such consumer-directed marketing messages as "Whole Foods, Whole People, Whole Planet", "Feel good about where you shop", and "Seafood flown in from our very own wharf."[9] It is nonetheless highly focused on financial success, having grown from its original single outlet in 1980 to 175 stores in 2006, and today to its total of over 300. Gross sales increased from $5.6 billion in 2006 to $9.0 billion in 2010.[10] As Johnston points out, "[WFM's] growth strategies are unabashedly entrepreneurial, garnering massive growth, profits, and an impressive record of expansion and acquisitions."[11]

The non-profit organization Slow Food International (SFI) was founded in Italy in 1989 and currently claims 100,000 members active in over 150 countries.[12] With its central message of working to create "a worldwide network of people committed to improving the way food is produced and distributed" and, overall, a food system that is "good, clean, and fair,"[13] SFI encourages consumers to buy locally, directly from farmers (or through the fewest possible links), and with attention to taste and traditionalism. Both organizations seem to show high levels of success, despite their competitive natures and ostensibly shared target prey. Furthermore, WFM's clear market growth has taken place during a period of challenging global economics and increasing regulation by such bodies as the American Food and Drug Administration,[14] while SFI has gone through a series of evolutionary steps, particularly in territories outside of the home base of Italy.[15] While the trophic model presents several elements that illuminate gastronomic patterns—such as the flow of energy from individual consumers to government organizations, and the equivalent trophic status of food retailers and

---

[7] For the discussion that follows, the word "consumer" is used to refer to the individual purchaser-eater of food in the real world, paralleled by "primary producer" in the ecological terms of the trophic model.
[8] http://www.wholefoodsmarket.com/company, referenced 4/23/11.
[9] Johnston, 230.
[10] Whole Foods Market, Inc., 6, 17.
[11] Johnston, 230.
[12] http://www.slowfood.com/international/3/how-we-operate, referenced 4/23/11.
[13] http://www.slowfood.com/international/3/how-we-operate, referenced 12/12/2010.
[14] Vaclavik and Christian.
[15] Josh Viertel (Slow Food USA President), personal communication, October 2010.

activist groups—it also demonstrates how a more complex model would be useful.

First, as predicted, messaging pressure from commercial marketers and non-profits can be seen to increase individuals' consumption of food, leisure activities, and social connection, that is, the sustenance that allows them to work, earn money, and purchase food (i.e., fall prey to their predators). Intriguingly, since food is in some ways "produced" by the same organizations that prey on consumers, the value of individuals' consumption behavior is doubled—they consume not only food messaging, but food itself, a type of feedback response that supports the predators even more strongly. This may partially explain both WFM's and SFI's ongoing recent success. Similarly, when consumers sustain themselves with their other basic needs of leisure activity, social connectivity, and sheltering experiences, their actions also support food/messaging consumption, since all three "nutrients" are closely associated with the direct consumption of food itself.

Further up the trophic chain, regulators may be viewed as a type of prudent predator. While the pressure they exert on marketers and non-profits does not have the cascading effect of releasing individual consumers from top-down pressure (as would be predicted by a traditional trophic model), their behavior does favor consumers indirectly by favoring the system overall. Regulation's goal is to protect consumers while allowing food marketers to thrive. This benefits the economy, one of the meta-goals of the governmental structure that regulators partially comprise. Their activity also promotes competition between various members of the primary predator guild, which in capitalistic terms promotes (eco)system health.

Finally, as in any trophic chain, reduction in fitness of the primary producers in this model will be observed to have an upwardly cascading effect. Less consumption by individuals (of food messages and the corresponding food products) results in reduced health of food marketers and non-profit organizations, ultimately providing the larger governmental structures with less tax revenue as well as less purpose or justification of existence (and therefore less operating budget distributed from the government's central finances).

Those ways in which the model fails to predict the success of such organizations as WFM and SFI are also valuable, and point to the additional variables that should be included in subsequent models, including the influences of the sub-systems of gastronomy that were noted above. These include the strong influences of changing global politics and taste, and the unknown motivations of regulators in supporting or repressing certain retailers or non-profits while supporting others. As stated, regulatory pressure rarely benefits the consuming individual

by debilitating marketers: communications guidelines are largely pre-established and so must be viewed more as structural elements of marketers' "habitat," rather than as a temporal variable. Because marketers' messaging efforts produce a positive effect on the environment from the government's perspective—that is, tax revenue—current government regulations tend to favor the large-scale marketer. Similarly, the level of predation through taxation on marketers is, for the most part, pre-established, reflecting once again the government's prudence. In the event that regulation surprises its prey with unanticipated tax increases, marketers generally pass the cost onto individuals; though preyed upon from above, the marketers are not weakened. In the case of non-profit or alternative organizations, regulation may have a weak effect on messaging, but because of their lower level of predation on individual consumers, there is little net impact.

From the observed cases of WFM and SFI, two other discontinuities at this level of analysis present themselves: first, consumers cannot be viewed as a single population of same-species primary producers, but are in fact divided into numerous different species with varying behaviors, requirements, and degrees of exploitability by primary consumers; and second, resources (workers, knowledge, practices) flow between primary consumers, that is, food retail workers sometimes become non-profit employees or volunteers, and vice versa. WFM benefits from some of the same messaging that SFI puts out (sustainability, fairness, quality), while SFI's exploitation of taste evolution, local outlets (chapters) and global expansion shares much with high-end food retailing.

As a model to predict small-scale interactions between food eaters and food sources, the trophic model demonstrates several useful notions, as discussed above. Like ecology itself, however, gastronomy has many more complexifying layers that influence interactions, including the cognitive-psycho-emotional principles of human behavior. As ecologist David Rapport points out regarding the myths of ecological and economic congruities, "it is difficult to justify the underlying assumptions and to find quantitative measures for the supposed objective function in decision making, for example, psychic satisfaction in economics; fitness in ecology."[16] Clearly, trying to shoehorn locavores, vegans, dedicated junk-food eaters, and farm-stand consumers, as well as market research, tasting events, and new strategy development into a four-level trophic model is not feasible. A next-level perspective that incorporates temporal shifts and geographic breadth is required.

---

[16] Rapport, 1.

METAPOPULATION DYNAMICS

As shown above, a simple trophic model offers some insights into food-messaging and consumption dynamics, although it lacks the complexity needed to predict behaviors at larger scales, which becomes relevant in discussing food production and consumption practices. In the contemporary western reality, these two activities are strongly linked to a great many mechanisms and places in the world, each with its own food system dynamics. Considering two aspects of the metapopulation model—migration and redundancy—may offer additional depth, or at least another angle on gastronomic system behavior.

In the metapopulation model, species migrate between habitable patches using corridors. This may allow a local population to seek out new or more appropriate resources, or to avoid the threat of predation. A local population may grow large and reach its local carrying capacity, then branch off a new local population through migration into a new and unexploited patch. Conversely, a local population may go extinct, either dying out or leaving its original patch, and then potentially being reestablished either through returning emigrants, recruitment from a more successful population in another patch, or immigration from a source population. In any of these cases, the metapopulation model helps explain overall population stability despite potentially large fluctuations at the local level.

A second notion to consider in this context is the potential for species redundancy at the larger scale. In this case, more than one species may be able to perform an identical (or very similar) functional role within the community or ecosystem, meaning that if one functional species dies out, another remains in place to perform a critical role. Moreover, the remaining species may increase its efficiency within that functional role, in order to compensate for the absence of the now-missing species.[17] Overall, the meta-system maintains its level of functionality, even if local patch dynamics have been changed.

Figuratively speaking, global markets and the internet can be construed as corridors that allow food produced in one patch to move to another patch, either physically (through distributors) or informationally. Thus, for example, as a supply of rice dries up in one production region, a distributor can simply look to another region where the species is not "extinct." Similarly, when a newspaper fires its restaurant critic (budget cuts!), local diners go on Yelp.com to search for reviews. The highly networked food habitat contains so many interlinked

[17] http://en.wikipedia.org/wiki/Ecosystem_services, referenced 4/23/11.

patches—both of messaging and of actual food—that populations (whether primary producers, functional species, or upper level consumers) are able to migrate into and colonize spaces that open up within gastronomy, due to disturbance, predation, or competition.

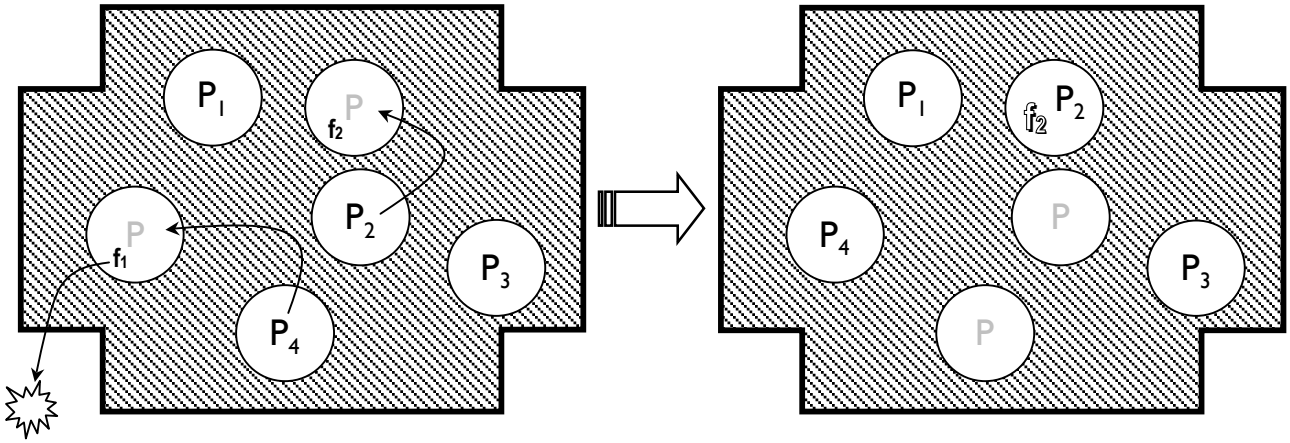

Figure 2: Metasystem stability in population number and functionality. While communities in local patches (circles) may lose functional species (f) and/or populations of individual species (P), the overall state of the metasystem remains stable.

Looking at the examples of Whole Foods and Slow Food, both organizations are distributed across a wide territory, each with local populations that collectively comprise migrational and redundantly functional metapopulations. There is a flow of both information (messaging) and people (individual members of the populations) between patches, and each displays overall stability (even growth, as shown by the numbers quoted above). Considering SFI as a metapopulation composed of thousands of local patches (chapters), the organization is able to maintain overall strength even as one chapter might experience a decline in membership or suffer periodic shifts in leadership. Geographical displacement of individuals also takes place (between cities), and Slow Food chapters literally recruit new members from other populations. In terms of messaging—towards members and non-members alike—Slow Food relies on a set of regional governors (at both the federal and provincial level), each of who is able to perform the roles of message originator and administrative coordinator.[18] This redundancy is built into the Slow Food structure, and has allowed the metapopulation to thrive and evolve, even as significant crises have taken place locally.[19] Another feature of SFI's migrationality is that one local population, Slow Food USA, in fact underwent a character shift in order to adapt to a new environment. Arriving in the United States in 2000, Slow Food strongly displayed the character

[18] Erika Lesser (former Slow Food USA director), personal communication, August 2008.
[19] Steager.

traits of the International species, and in fact became weaker in its new environment due to the presence of different available resources (consumers, products, attitudes, tastes). In 2008–09, the American organization underwent considerable internal change, becoming more autonomous from the parent organization, and creating messaging that spoke more to the Slow Food member than about traditional products or historical food practices. "Making it possible for everyone, at any level, to plug in," and "good food should be a basic human right" became the underlying principles of Slow Food USA,[20] a more visibly political positioning than the home-country's subtler expression of politics through a focus on local, artisanal, high-quality products.[21]

Whole Foods has received criticism for its "commodification of nature through food products,"[22] an issue that may have slowed its expansion into the relatively newer regions of Canada and the U.K. Viewed through the metapopulation model, however, the branching corporate structure can be perceived as a source of ongoing local populations. WFM maintains an overall population strength through migration and colonization. The establishment of a foothold in Ontario (two stores in Toronto) appears to have enabled the organization to grow locally, increase market presence in Ontario, and then migrate to a new unoccupied patch, opening its first store in Ottawa in 2014.[23]

Viewed at a larger scale, in which WFM and SFI are seen as species within a larger gastronomic meta-system of numerous retailer and non-profit populations, this model might predict that any of these organizations could become locally extinct due to competition from other guild members that prey on the time/money/energy of individual consumers. This has indeed happened. A company similar to WFM, Wild Oats, played a similar functional role in past: supermarket-style retailing of natural and organic foods. Because of rapid expansion, it faltered in the market and eventually failed (eventually being bought by WFM). WFM, playing an equivalent role in this part of the gastronomic system, was able to replace the functionality of the lost species; indeed, it has grown more robust in doing so. The gap created by the disappearance of Wild Oats allowed WFM to rise functionally.[24] (Viewed through more traditional market-economics models, Wild Oats went out of business because it couldn't compete—WFM was a more effective predator.)

---

[20] Josh Viertel (Slow Food USA president), personal communication, October 2010.
[21] Steager.
[22] Johnston, 261.
[23] http://wholefoodsmarket.com/stores/toronto/2011/02/10/whole-foods-market%E2%80%99s%C2%AE-ontario-expansion-continues-in-ottawa/, referenced 4/23/11.
[24] http://en.wikipedia.org/wiki/Whole_Foods_Market, referenced 4/25/11.

PANARCHY

As noted in the introduction above, it appears that both ecological and gastronomic crises have been increasing in frequency and severity, notably since the rapid expansion of industrialized agriculture and manufacturing that has characterized the last century. While linked to ecology, breakdowns in various aspects of gastronomy often draw separate public and political attention because of their very immediate and visible impact on humans. These include public health issues such as obesity and diabetes, food security and inflating consumer price indices, and the less evident but equally problematic issues of social and familial instability, and loss of cultural and national identity. Food historian Warren Belasco, in his book *Food: The Key Concepts,* invokes a 1948 quotation from ecologist William Vogt: " 'By a lopsided use of applied science, mankind has been living on promissory notes. Now, all over the world, the notes are falling due.' "[25] More than 60 years later, that statement seems ever more ominous, but also calls into question why a complete collapse has not taken place—or if it has, why we do not perceive it as such.

To better understand the gastronomic conditions that enable crisis to emerge, it is useful to consider both long- and short-term cycles of interactions, as well as the meta-behaviors of linked systems within a larger-scale ecosystem. At this point it is also worth increasing the scope of gastronomic observation beyond just the marketing messages of Whole Foods and Slow Food. Consumption of industrialized food (or resistance to it) is driven in part by communications, as described above, but in moving into a more complex ecological model, I have chosen also to examine certain patterns within the production and distribution processes that food messaging ultimately serves.

Ecologist C. S. Holling, along with his colleague Lance Gunderson, describes *panarchies* as "hierarchically arranged, mutually reinforcing sets of processes that operate at different spatial and temporal scales, with all levels subject to an adaptive cycle of collapse and renewal, and with levels separated by discontinuities in key variables."[26] Holling acknowledges that the model is not deduced from first principles, but is based on a synthesis of empirical studies; he views ecological environments as complex systems that are interlinked with additional complex human systems and human-nature systems.[27] Urban systems and economics may therefore follow the same model, a theme echoed by political scientist Thomas Homer-Dixon, who

[25] Belasco, 105.
[26] Holling et al., 3.
[27] Holling et al. 5–6.

proposes that panarchy is useful in observing social and information infrastructures, as well as the systems involved in food production and distribution.[28]

While Homer-Dixon uses panarchy theory to explore environments that are more related to humans than to plants and animals, he points to a number of issues that are relevant here. First, one of the key characteristics of complex adaptive systems is the lack of defined boundaries between inside and outside, and between one system and the next: components of one system bleed into another. Second, systems are invariably linked by a large number of dynamics and interactions among these components[29] (e.g., political motives enter into conservation decisions, climate affects commodities prices). Third, the number of components in these systems and their degree of connectivity is generally high, and because of this level of interaction and activity, system behaviors are non-linear, hard to predict, and display the phenomenon of *emergence,* that is, unexpected or surprising properties.[30] Fourth, complexity increases within systems as they develop. Drawing from complexity theorist W. Brian Arthur, Homer-Dixon cites three processes of complexity expansion: the "growth of co-evolutionary diversity," which both creates and fills niches in the system as new species evolve; "structural deepening," regarding character displacement in species, in order to deal with competition; and "capturing software," meaning that larger systems absorb the submechanisms of smaller systems.[31]

Returning to Holling, the panarchy model describes a cycle of growth, renewal, collapse, and system reset. In ecology, panarchy may therefore predict the behavior of an environment after a major disturbance, along with the successional stages that follow. The two key variables involved in the cycle—potential and connectedness—are dependent on interactions between species and the availability of biomass for species exploitation. A third variable, resilience, describes how well the ecosystem will respond to disturbance. Resilience, in both ecology and food systems, can be seen to reach a maximum state before the same variables that brought it there act to reduce resilience and set the conditions for cascading collapse. Figure 2, below, shows the flow of system activity and the elements involved.

In this rendering, the circles represent four stages of development in the complex system, closely paralleling those of ecological succession, but differing because of interaction with other complex systems (including human components). Stage A is characterized by early

[28] Homer-Dixon, 2011, 2.
[29] Homer-Dixon, 2011, 2.
[30] Homer-Dixon, 2011, 3.
[31] Homer-Dixon, 2011, 4.

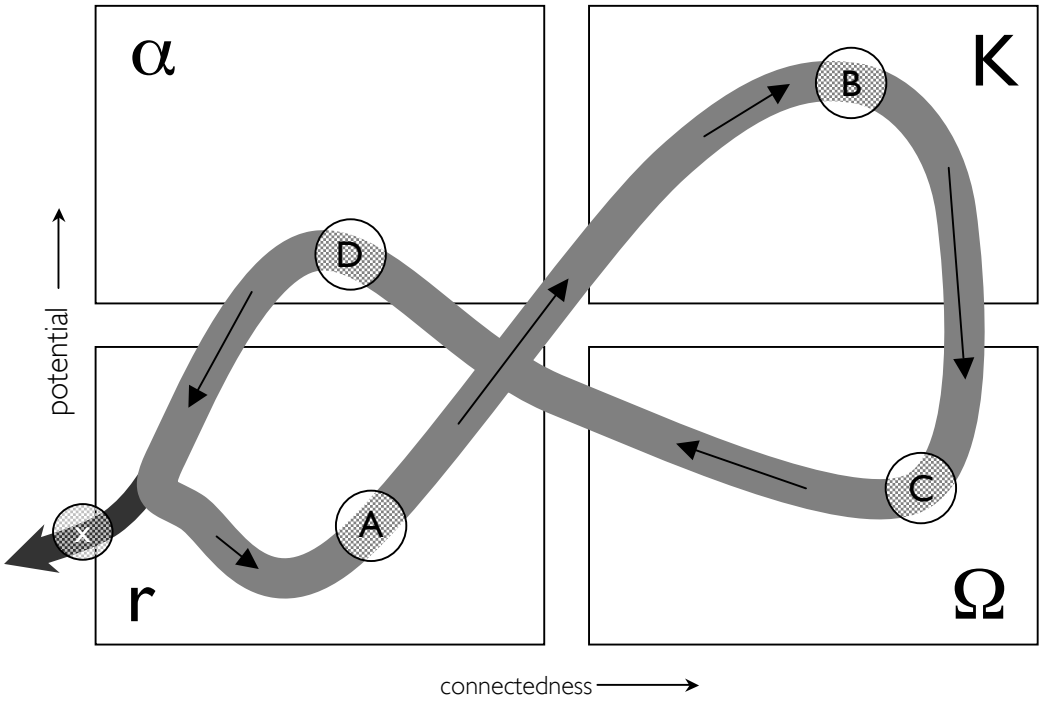

Figure 2: Flow of resources during system evolution. The y-axis shows increasing system potential—in ecological terms, accumulated biomass and nutrients. The x-axis shows increasing connectedness between system species—that is, predation, habitat structuring, and other dependencies. A third variable, system resilience, and the exit of resources from the cycle, shown here as x, are described in the text below. (Figure and details adapted from Holling et al., Figure 1.2)

exploitation of available resources by opportunistic, rapidly reproducing r-selected species and the resulting habitat structuring they engender. During stage B, similar to later-stage succession, more competitive K-selected species conserve resources, and the system builds towards a climax state. In stage C, resources are released into the system after disturbance and collapse, followed by stage D, at which point system reorganization takes place and the cycle resets. It should be noted once again that panarchy theory is intended to describe the hierarchical structure of patterns between interlinked human-*and*-nature systems, rather than within purely untouched natural environments. The notions of r-selected and K-selected species, climax state and disturbance, as well as connectedness, resilience, and potential, can all be applied to both biotic organisms and abiotic structures, as well as human or social constructs.

As indicated in the text accompanying Fig. 2, from an ecological perspective, "potential" is the accumulated resources of biomass and nutrients in the system; in the broader framing of all complex adaptive systems, as Homer-Dixon expresses it, potential is the "possibility for novelty within a system"[32] or the number of variables, actors, and other things that possess some form of agency to affect the system. Connectedness represents the links, dependencies, or relationships between these components, for example government regulations and salmon stocks, or rates of deforestation and McDonalds outlets.

[32] Homer-Dixon, 2011, 8.

Homer-Dixon proposes that, as the cycle approaches the B stage, the level of resiliency in the system decreases. Contrary to what might be seen in a forest's climax state, in which stability is achieved due to increased biodiversity, here resistance to disturbance is low: the stage is set for a cascading failure. This is because the system's potential is bound up in a relatively small number of K-selected individuals, leaving few available resources for the remaining r-selected species to exploit. The overall system potential is technically high, but actual potential for innovation is low. At the same time, as the system has, in Homer-Dixon's words, "pruned away much of [the] redundancy"[33] by allowing a few key functional species to thrive, and letting others with similar functions die away. The system, lacking innovation and redundancy, but tightly coupled by species interdependencies, has become brittle and vulnerable for a cascading failure. Moreover, because of the unpredictability that is characteristic of complex systems, the potential exists for what Homer-Dixon and Holling call a "flip" state, shown by the circled **x** in the lower left of Fig. 2. Flows across boundaries, into other complex systems, may allow resources to exit the system altogether before being exploited by r-selected species in the A stage. This radical shift in overall potential is obviously cause for concern and, in ecological terms, may indicate a sudden change, such as rapid desertification or an extinction of large numbers of species. In gastronomic terms, it could entail a food-borne disease outbreak, a collapse in animal stocks, or an uncontrolled price spike.

C. S. Holling himself has questioned panarchy theory, positing that it may be "a consequence of the way analysts and modelers make convenient modeling decisions and simplifications . . . [rather than] an accurate depiction of the way ecosystems, industry, and management actually organize and function."[34] As a tool for considering how gastronomy functions, however, it critically underscores the role that humans play in bringing food systems to a dangerous level of brittleness and, more significantly, how we seem to have remained in this state for some time. I consider again Thomas Homer-Dixon's explanation:

> Cycles of breakdown and renewal are normal in modern capitalist economies. Companies go bankrupt, and new ones emerge in their place; established economic sectors disappear, to be replaced by industries driven by new technologies; and recessions shift capital from inefficient firms to productive ones, while helping to purge the excesses of earlier boom times. Joseph Schumpeter, one of the twentieth century's greatest economists, famously called these processes a "perennial gale of creative destruction" that's spurred, in part, by the relentless innovation of entrepreneurs. But elsewhere in our societies, rigidity is the rule rather than the exception.

[33] Homer-Dixon, 2011, 11.
[34] Holling et al., 6.

> Powerful habits, beliefs, and vested interests hold sway, so things like underlying structures of wealth and power and entrenched patterns of social and consumer behavior don't really change.[35]

Homer-Dixon's "powerful habits and vested interests that hold sway" manifest themselves in social and economic and political structures. Large-scale agribusinesses are the K-selected species of the panarchy model, which occupy huge numbers of resources in people, land, production, and market share. The tight system connectivity supports this occupation, by extending such organizations' reach through processing and distribution companies, retailers, and product marketers. In turn, prolonged marketing communications efforts build up strong brand-equity associations, coupling product purchase and usage to the individual consumers' emotions and belief systems. The repeated act of consuming the messages of large-scale marketers, and the associated act of eating their food, appears to sustain the overall system in the B stage.

As predicted by panarchy, the net system impact from organizations like Slow Food, Équiterre, or local farmers' groups (the r-species of this model) will be weaker. They are fewer, smaller in size, and less competitive, and the usual communications and distribution channels are bound up with K-species' efforts. Though perhaps more innovative and nimble, the alternative-scale entities have fewer economic resources to draw on, which means fewer and less powerful messages or products reaching the consumer.

Similarly due to very human response mechanisms, efforts (messaging or otherwise) from government, media, and activists regarding the externalization of waste products are ignored, increasing stresses on the system. While government-to-business messages may temporarily solve for these externalities (through technocratic containment programs), methane, phosphorous, and processed-food packaging waste nonetheless accumulate, as well as the impact on human and planetary health. Oceans acidify, algae bloom, and obesity rates climb.

The question remains as to why, after one hundred or more years of increasing food industrialization, and the accompanying increases in gastronomic complexity, no cataclysmic failure has occurred. The first response is simply that we haven't gotten there yet, and that there is more room in the system for growth. A second response, proposed by Homer-Dixon himself, is that smaller (though by no means insignificant) breakdowns have already taken place. One need look no further than Atlantic cod stocks, public health crises, and the all-too-frequent outbreaks of *L. monocytogenes* and *E. coli* for examples. These periodic, medium-level collapses

---

[35] Homer-Dixon, 2007, 289-90.

(including political, economic, and climatic crises) may allow the system to remain in dynamic quasi-equilibrium around the panarchy B stage. This has been observed not just in such worlds as those occupied by Whole Foods and Slow Food, but elsewhere in gastronomy: the Tricon restaurant chain reorganizes and sells off subsidiaries, *Gourmet* magazine goes out of business, Monsanto loses a patent-infringement suit. As these K-species of gastronomy have decayed, resources have been freed up for more innovative r-species, which quickly multiply and offer consumers new and more sustainable food options. The curve creeps again towards climax, and another K-species falls, releasing potential. Whether or not the panarchy model applies, the very broad connections of gastronomy to other complex systems must certainly be a source of ongoing and disruptive vicissitudes.

CONCLUSION

In her book, *Meeting the Universe Halfway,* Karen Barad traces the development of quantum theory—from both its ontological and epistemological roots, as well as through the philosophical stance of some of the physicists who participated in its evolution—in order to examine matter and meaning, and their relevance to cultural and feminist theory. Trained in particle physics, she eloquently warns the reader about the danger of using analogy in analytic reasoning: "[Analogy] posits separate categories of items, analyzes one set in terms of the other, and thereby necessarily excludes by its own procedures an exploration of the nature of the relationship between them."[36] While ecology and gastronomy, as stated earlier, share overlapping items and categories, they are indeed separate. In drawing parallels between ecology and gastronomy, my intent is not to determine one best model for predicting gastronomic behaviors, nor to explain a hitherto misunderstood aspect of gastronomy. Rather, I am interested in identifying the limits of these analogies and questioning why the limits present themselves, as well as in why certain patterns emerge and have resonance.

Further into her book, Barad expands on her charge against analogy, offering an alternative approach. Whereas analogy uses reflection as a tool of analysis, she proposes using *diffraction.* That is, identifying patterns of interference between separate categories, in order to see their unique properties. (Yes, this is an *analogy* of optical diffraction, but in both Barad's and my view, an acceptable one in the pursuit of a useful methodology.)

---

[36] Barad, 23–24.

I believe that the value of ecological models to understanding food-system dynamics is in the interference patterns that emerge between ecology and gastronomy. That is, those moments when it becomes clear that additional variables or scale increases are necessary in order to more accurately describe observed gastronomic patterns. These may be the variables of humanity's influences and power, emotional and psychological motivations for behavior, or randomness in economics or politics. Similarly, shifting the physical scale of the observed setting helps to view the nestedness of interactions in gastronomy, and that such "simple" behaviors as sending and absorbing communications messages are inherently linked to numerous other behaviors and actions. Any complete systemic model, as shown above, is not fully effective in either describing or predicting gastronomic events. Rather, smaller segments of models, held up to food, can be illuminating.

The diffractive approach may be most effective in unpacking panarchy. The layers of complex systems that are necessarily involved in food—and the tightly coupled relationships between politics, urban and rural systems, climate and plant science, economics and culture, and so on—make evident how chaotic the "whole system" actually is. Probing elements of the panarchy model, then, is the only way to take value from it. Viewing an alternative-scale food promoter as an r-selected species, the question then becomes how Slow Food can help preserve or alter a habitat to help that r-species thrive. Its relationship to K-species and the available potential may not follow panarchic predictions, but the value it may offer as, for example, a habitat engineer, can be used in the efforts designed to support its growth. Similarly, taking Whole Foods as K-species, we need to ask how the company can continue to thrive without blocking other species from performing similar roles and enabling system resiliency through ongoing innovation.

My aim here has been to take an initial step in considering how certain elements of ecological models can serve to better perceive food-system dynamics, and whether such an approach is useful. From this beginning discussion, I believe that it is, and that future work can further build up a framework around gastronomy that makes its patterns and processes more evident and understandable—potentially using diffractive analyses and comparative models from a variety of disciplines, in addition to these of ecology.

REFERENCES

Works Cited

Barad, Karen Michelle. 2007. M*eeting the Universe Halfway.* Durham: Duke University Press.

Belasco, Warren. 2008. *Food: The Key Concepts.* New York: Berg.

Brillat-Savarin, Jean Anthelme. [1848] 1949. *The Physiology of Taste.* Trans. M.F.K. Fisher. Washington: Counterpoint.

Capatti, Alberto. 2008. "Introduction," in University of Gastronomic Sciences Prospectus. Pollenzo: UNISG.

Farrell, Joseph, and Michael L. Katz. 2005. "Competition or Predation? Consumer Coordination, Strategic Pricing and Price Floors in Network Markets." *Journal of Industrial Economics* 53 (2): 203-231.

Faure-Grimaud, Antoine. 1997. "The Regulation of Predatory Firms." *Journal of Economics & Management Strategy* 6 (4): 849-876.

Grimod de la Reynière, Alexandre Balthazar Laurent. [1812] 2003. *Almanach des gourmands.* Paris: Mercure de France.

Holling, Crawford S., Garry D. Peterson, and Craig R. Allen. 2008. "Panarchies and Discontinuities." In *Discontinuities in Ecosystems and Other Complex Systems.* New York: Columbia University Press.

Homer-Dixon, Thomas. 2007. *The Upside of Down*. Toronto: Vintage Canada.

Homer-Dixon, Thomas. 2011. "Complexity Science." *Oxford Leadership Journal* 2 (1). http://www.oxfordleadership.com/journal/vol2_issue1/oljindex.html.

Johnston, Josée. 2007. "The Citizen-Consumer Hybrid: Ideological Tensions and the Case of Whole Foods Market." *Theory and Society* 37 (3): 229-270.

Kozinets, Robert V., and Jay M. Handelman. 2004. "Adversaries of Consumption: Consumer Movements, Activism, and Ideology." *Journal of Consumer Research* 31 (3): 691-704.

Rapport, David J. 1991. "Myths in the Foundations of Economics and Ecology." *Biological Journal of the Linnean Society* 44 (3): 185-202.

Santich, B., 1996. "Sustaining Gastronomy," in *Proceedings of the Eighth Symposium on Australian Gastronomy: Sustaining Gastronomy*, Adelaide.

Slow Food International website, http://slowfood.com/international/3/how-we-operate, referenced 4/23/11.

Steager, Tabitha. 2009. "You Say Pleasurable, I Say Political: Political Activism and Cultural Translation in the Slow Food Movement." Vancouver, BC: UBC.

Tsing, Anna, for the Matsutake Worlds Research Group. 2009. "Beyond economic and ecological standardisation." *The Australian Journal of Anthropology* 20 (3): 347-368.

Vaclavik, Vickie A., and Elizabeth W. Christian. 2008. "Government Regulation of the Food Supply and Labeling" in *Essentials of Food Science*. New York: Springer.

Walker, Brian. 1992. "Biodiversity and Ecological Redundancy." *Conservation Biology* 6 (1): 18-23.

Whole Foods Market website, http://www.wholefoodsmarket.com/company, referenced 4/23/11

Whole Foods Market, Inc. 2010. "Form 10-K." Downloaded 4/25/11 from http://www.wholefoodsmarket.com/company/pdfs/2010_10k.pdf.

Wikipedia.org. "Ecosystem Services." http://en.wikipedia.org/wiki/Ecosystem_services, referenced 4/23/11.

Wikipedia.org. "Gastronomy." http://en.wikipedia.org/wiki/Gastronomy, referenced 4/25/11.

Wikipedia.org. "Whole Foods Market." http://en.wikipedia.org/wiki/Whole_Foods_Market, referenced 4/25/11.

Wiktionary.org. "Gastronomy." http://en.wiktionary.org/wiki/gastronomy, referenced 4/25/11.