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NIGHT FLIGHT ACROSS A BLUE SKY: PROGNOSTICS

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It is easy to have questions misunderstood and to get unexpected answers. These answers are often humorous, not because of the words but because of the expectation and the contrast. They cause response because of their environment, their context. Most people think of context as two or three-dimensional. One of these dimensions can be called "perspective." We frequently speak of our perspective on a problem, where we stand within a context to view a question. It is very difficult to get even one good perspective; several perspectives are needed so that a choice can be made as to which is best. One means for gaining a new perspective is to attempt to work with questions about the likely future. Such effort can change the time dimension and provide a point on which we may stand, conceptually, and look back on the present.

The purpose of this presentation is to gain new perspectives on pest control and related phenomena. Some will call it "blue sky." I would claim it informal futuristics. Systems men call such efforts feedforward; others grandify it with "prognostics." Some say prognostics is one of the leading challenges of the day. We must anticipate future developments and imagine or invent new alternatives as a background for rational choice. The activity can influence today's decisions, modify our concepts of risks and probable payoffs, and can help those of us who ask: "What am I really doing; what should I be doing?"

The responsible scientist-citizen in the audience will surely be asking himself, "If I'm to take this night flight, who's the pilot? How does he know?" Well, no one knows about the future. Nevertheless, the future seems relatively clear to me as a result of long and serious thought, certain reading, particularly in the realm of futuristics, forecasting, and involvement with my students in some large system modeling and simulation. I cannot *prove* anything I present tonight, for evidence, by definition, is *a posteriori.* But I solicit your thought, reactions, dialog and most importantly, in some instances, efforts to cruch my fundamental assumption. That assumption is "… if present rates continue."

One of the reasons for prognosticating is to cause change. The futurist squirms in a field of tension between desiring to be right in his predictions and hoping that his dire insights will never materialize. The tension from another direction is describing the future as it *can be* or as it *probably will be.*

A revised version of the after-banquet presentation.

From where I see things … look out of your window as I bank the plane …

Livestock production has now become very intensive. The western ranges are virtually barren of cattle for the costs, even with continued but declining government subsidy, makes it a sub marginal operation. The old conflicts between wildlifer and livestockman no longer exist. Big game has increased significantly and now major problems exist in population control to achieve desirable watershed management. Hunter populations have significantly decreased because of costs of travel. The quality of the hunt has decreased even though many hunters can get a good rack (Who wants one in modern low-ceiling rooms?). Fewer people and families have had prior hunting experience, thus compounding the rate of decrease of hunters. Big game control, now called an “ungulate balance program”, is a major rangeland problem throughout the U.S., even in the densely populated East where mean hunter efforts in distance from roads has declined from 0.8 miles to 0.4 miles.

Sheep continue to be the only suitable means for ecological succession control in some areas, and continued conflicts exist between sheepmen, both public and private, and public agents managing bear, bobcat, coyote, and cougar populations. Land use debate continues about the efficiencies of meat production by sheep and land use optimization. The multiple questions of goals, values and use - by whom? - persist. Due to delayed public policy and residual laws, many private sheepmen, operating well below the economic margin but “shored up” by various subsidies, continue to exercise exorbitant influences on proper wildland resource management.

The unifarm is now a reality. A blend of the old co-op and a decadent concept of agri-business, the unifarm now occupies the interests of half the systems ecologists of the world and a major portion of the operations research specialists. The unifarm is a land mass operated as an industrial system designed to produce a net optimum mix of ranked benefits indefinitely. Plants and varieties are selected to be exactly compatible with latitude, longitude, elevation, and cloud phenomena. Acreages are optimum; new boundaries have been struck by sales, trade, and even donations. Outputs are a complex chain of events from automated soil sampling, site specific fertilization and irrigation, automated harvesting, centralized feeding, recycling of all waste products, multi-storied buildings housing livestock and processors, product specific transportation devices, and on-site partial or complete processing or manufacturing. Each unifarm employs many licensed pest managers, all expert in integrated pest management, all as team members with specialties, all of which unite to develop strategies to play against nature so as to win most, sufficiently, over the long run. Integrating meteorology, population dynamics, cultural rotation, animal nutrition and pathology, plant succession, toxicology, application technology, plant physiology and pathology, entomology and economic theory into sophisticated computer-based optimization systems, they operate as a major sector of the planning staff and directors of the unifarm.

The unifarm, once conceived as a monoculture, is not. Under the harsh economic questions of *long-term* corporate interest, the answers -- diversity, balance, stability, ecological compatibility -- all became evident, overpowering the earlier myopia.

The net result will be one of increasing diversity among pest control people -- one of extreme sophistication working on the edge of knowledge and the other working on the rear end of ignorance, clients more interested in "make-do" than in solutions, owners operating at margins at which one sparrow too many means economic collapse, and public agents trying to cope with ill-conceived bureaucratic policy and ecological ricochets and imbalances of commodity-group sponsored legislation.

Continental cooling continues, exponentiating the energy crisis. Heating costs increase; transportation costs increase. Suburban sprawl, once a dynamic condition, is now static, with its own problems. Few can afford to commute; new suburban satellite communities develop. There is a return to the village concept, the new neighborhood. Mortgage crises arise in the tension between suburban home and urban work. Many people lose their houses; new suburban slums develop with associated pest problems. Re-zoning problems increase; new central service centers develop within biking distance from neighborhood clusters. Transportation costs have influenced meat prices and, simultaneous with population increases and first and second-class land loss, crop and crop land prices escalate. Pest control, previously marginal on low value crops, now is essential to achieve the production for the population. New tensions arise among pest control people, causing major organizational problems. The division widens between those responding to excessive demands with old, gross, unintegrated, and simplistic curatives, and those racing toward highly rational, sophisticated, cost-effective control strategies. The gap widens due to education, interest, and even flagrant violations of technological principles and ethical precepts. The tension increases while certain sectors of the pest control discipline heap reputation problems, and while others climb to new peaks of understanding and scientific management of complex dynamic systems.

The Bureau and the Extension Service will have lost so much credibility and suffered so many real penalties as a result of legal suits that it will have moved out of most pest control activities. Think-tank activities will persist within these agencies as will some special long-range, applied and regional problem efforts. Fundamental research will be dealt with through NSF or related groups. Applied research and development will become a private concern since profits can be made from having such answers. Commercial taskforces will be common-place since no company can afford to maintain a staff sufficiently powerful and dynamic to accommodate the problems that arise. Competition will heighten the expertise and advice available to the public. Loss of "free" advice (no matter how bad) will expand control markets.

A new attitude of managerial robustness will emerge among a group of pest control leadership. This concept will bring a draft of fresh air into a very stuffy environment. The concept is one of the convergence of:

A. Certain decisions can never be "good"; many (and an increasing number, unless population and other trends slow) must be decisions of selecting the least bad.

B. Evaluation based on where you can take a population (how low?, how high?) -- on *potential,* not on how far we have come or how great a change has been made, and,

C. N-dimensional complex trade-offs. This last means there are a bunch of ways to achieve control and there are a bunch of ways to create a problem -- that is, unwanted results. Often little mistakes are as bad as big ones, and, coming around the other way, big errors sometimes may not result in big problems (in lost benefits). It's a tough thing to think through. Often computers will be used and needed. The pest management industry eventually will leave some of its pest control problem solution to experts (like now done in medicine), and stop screaming pitiful assertions.

Public personnel, both the new and holdovers, will increasingly be involved in operating and refining monitoring systems - both to predict future pest problems as well as to assess the primary and secondary consequences of control activities.

Have you ever trapped for bobcats and walked up on one in the trap and wondered whether it had you or you had it? That's the way it will be increasingly in the future. Our control technology will increase both in amount and diversity. This will make the decisions more difficult, the risks greater, and the consequences harder to predict. Increasingly the technological rule will be: "Just because I can, it doesn't mean that I must." The new technology will range from architectural design control, building code provisions, through automated sampling systems to subtle manipulation of enzyme systems, not only of pests themselves, but also of pest pathogens and parasites. Few new "technologies" will be evident but new applications of existing ones will emerge. Emphases will be on enzyme chemistry and manipulating the bioenergetics of pest species. The new technologies will be legislative controls, and tax schedules, advanced educational systems, sophisticated land management that reduces the habitat of or duration of habitat for pest population build ups, and systems for optimally integrating fairly commonplace techniques.

As an example of integrated systems, I now have developed a computer system called FANCY, played as an instructional game or used as control tool, that determines how to select an orchard site, space trees, and how to optimally select and combine during a season 30 insecticides, fungicides and herbicides and apply them during 16 periods to control 25 pests of Virginia apples, in a mixed species orchard, each pesticide having different cost, effectiveness, and different effectiveness under rain, each year having the chance of frost, all played against a probabilistic market value for five grades of apples. The payoffs are all in profit. The tradeoffs between various pesticides and their wildlife toxicity are readily apparent. The worth of wildlife to the orchardist becomes his opportunity cost. One result is the wildlifer no longer says "no" but is now in the position of saying "here's how" - both to improve apple profits as well as reduce wildlife and other ecological hazards.

Larger systems will become dominant. Like my system called "Waterloo," it may become required that all large pesticide applications must be subjected to a licensing procedure, a "prescription," based on a computer simulation run that inspects before application, the effects of the substance if applied.

Human behavioral control will become highly operative and efforts will be directed toward shaping the users' concepts of control. Game-theory will become the behaviorists' theoretical foundation as he struggles to reduce differences between control achieved and control needed. Efforts will be directed at reducing expectations, at reducing "tolerable loss." More attention will be paid economics and the real and net returns from control expenditures. In the face of excessive claims of success by some companies, public monitoring, or overseer groups will become operative. There will be *Didactrons* in all major educational centers (Giles and Huffman, 1973).

Public participation will have matured past its present "dirty diaper toddle" to a shift and beautifully running computer based input system employing a vote followed by a picture of the probably consequences of a majority vote of the same type, followed by a chance to change your vote. In addition there will be partitioned votes, denying the grossness of present concepts. Instead of "do you or don't you want the dam or this aerial application?" the questions will be directed to the dimensions of how much, where, how much esthetics, at what costs, what extra benefits, and for whose benefit? These will then be re-assembled, re-built into a decision that tends to maximize the probability of net-weighted benefits to all the people.

Let me conclude with a final blare of heresy. The well intentioned calls for cooperation and team work will have died out. Giles' law of research will be proven: "with increasing cross fertilization of ideas, the feeling of being screwed increases." I'll never forget the cold day on a Virginia farm when a farmer said to me, criticizing some USDA publication about cooperation, "Let me tell you about cooperation." Pointing to two fat sows lying on the ground close-up against each other on the frost-covered ground. "Now there's cooperation; but neither one of them is lying there to get the other one warm." There will increasingly be specialists, hell-bent on particular excellence, but with one eye out for connections, and a willing attitude in order to gain "justification points" resulting from demonstrated use of research. The systems man, the environmental cybernant, will be the user, the integrater synthesizer, the producer of functional systems for decision makers -- including the research administrator.

The simulation will become a major tool of such decision makers for it will enable them to discover the major unknowns, to discover where the greatest explanatory power and prediction will be gained per dollar spent.

There is much more I can talk of -- the detailed problems of feed lots, total pest management system for the modern city, spatial analyses of wetlands and the profound influence of the newer niche concept (Hutchinson, 1965) as an n-dimensional hypervolume, the failure of but continuing hope of land use legislation, and pest management on new town-farms and urban open-space and cropland easements, the reduction in development *out-there* as gas prices soar, the rising tragedy of exotic game and its control, the problems of pest management in hi-rise farms, the emergence of a new environment and health partnership, and the awesome emergence of new neurological disorders, synergistic manifestations of crowding, pollutants, and the best-possible most-rational applications of pesticides.

It is late but let me change the metaphor of my title, *Night Flight Across a Blue sky.* Of all the things in the world most stirring to me is the sight of a waterfowl or redwing flock across a marsh at evening, backed by blue sky and black pine silhouettes with salmon and orange margins. I worry about the time spent in the office, the rate at which I gain descriptive and predictive equations, the increasingly objective, quantitative, and "cold" control I gain over systems and their management. I worry, for I dimly remember the magic of my early career. That is no more than professional nostalgia; I do not long to return to that. But the scene -- a flight of birds at evening -- they convince me that I am still alive and well, of the continuing worth of a world so wounded that it is beginning to stink, and that tomorrow -- after a rest and some dream time -- the real work of world management lies ahead of me.

Literature Cited

Giles, R.H., and S.A. Huffman, Jr. 1973. Heuristic teaching environments: a design document. Trans. Amer. Fisheries Soc. 102(3): 658-662.