

RURAL FUTURE



An Alternative for
Society Before 2050

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What is it Really?

I'll try again for brevity: What's Rural System, really?

Rural Future is a book about Rural System, a startup private corporation with a plan (in general system structure) to improve rural conditions for people who have not emigrated, or for people who are now urbanites who own rural lands and related resources and may wish to return. Rural System attempts to respond to international needs to be encountered in 2050 AD, partially by describing a computer- and technology-aided response to state appeals for employment, and improved productivity and stability of the diverse resources of rural areas of Virginia. It presents an alternative to recent unsuccessful farming, adds jobs, and responds to intensified needs for quality waters and lasting food supplies for likely increasing human populations.

Rural System is a proposed and developing modern corporation that works within a set of premises, listed in Appendix 2. The premises, un-weighted or ranked, tell what's behind many of our thoughts and decisions.

In securing participants, we are attempting to provide “price incentives” for land owners and investors in Rural System, hoping that they will align their actions with both personal and social interests. We work with land owners who have emigrated to the cities or “away” (however described) and, under lease with them, manage their lands for multiple, mutual benefits for them, the corporation, and the people of the region. We work for our money and provide fees for a very special kind of land “use,” that of increased profitability, beauty, stability, and value for the future and for nearby rural communities.

We see people emigrating rationally for mobile resources, labor, new capital, lower expenses, better services, and family cost-effectiveness. Rural System provides insights to loss of rural lands for land owners as well as people of rural regions and provides solutions for changing land and its uses and values for the future. Economist Boyd argued that “innovation thrives when private markets – and the incentives and information they provide – can be harnessed.”¹ That is what Rural System attempts: innovative uses of research results brought daily to workers in the field, for applications on computer-determined optimum sites, selected by searching data banks. Rural System involves a modern, novel use of economics with energy-conservation, esthetic sensitivity, a regional ethos, and evolving knowledge of rural ecological systems.

Rural Future tells details and stories about the proposed Rural System. It is a plan for a real system to be implemented. It can be planned in greater detail, modeled, and details improved. It now has many constructive concepts, data bases, technology (computer, GIS, social media, etc.), and is needed for the very near future. It's for farmers and farms, but also for us all, to develop adequate food and water sources before 2050 AD... first in a region, then Earth around.

Really.

¹ Boyd J. 2013. The Limits to Ingenuity: Innovation as a Response to Ecological Loss. Resources Magazine [Internet]. [cited 2017 Apr 18]; 182:41-45. Available from: <http://www.rff.org/research/publications/limits-ingenuity-innovation-response-ecological-loss>.

Chapter Three

Human Food from the Restored Land

Rural System is a planned, working response to a world full of stress and change, of new investment and hiring practice, international relationships, rapid technological change, exploding information, and untested methods of education. Intermingled with these are the uncertainties of national and local actions, faced with a set of environmental crises.

We propose a rare market turn, for we invest in rural-related companies, within a system operated for stable, long-term profits—which results in a stable natural resource base. We plan at the forefront of market-based approaches to environmental regulation; high, specific productivity; directed waste; and even quality of life. We explore Alpha-Unit-specific management for production and reduced waste of our branded, high-nutrition produce.

We know that environmental values can never be fully translated into dollars and so we show the extent to which they are translated over time. We guarantee a long-term perspective, and change actions which simulations assert will be destructive on the lands and waters. We no longer believe, but test skeptics and major project advocates saying that “environmental values will come out on the short end of the stick” in cost/benefit analyses. We can now use market values to help achieve major social and environmental values.

Behind Rural System’s plans to work for produce and profits locally is the need to set up a responsible, inter-nation system to feed a yet-increasing world population of nine billion people by 2050 AD. Keeping that from being a simple suggestion, we reluctantly concede roadblocks to it occurring, like new or newly intensified climate change storms and coastal flooding for novel, episodic human muscular challenges (against the apparent political rule on non-disclosure).

As we share in this book, we have become aware that systems are needed and can be created to link research and study results (converted into system inputs) with objectives and processes (i.e., policy formation)—strategic intent with optimization results and corrective progress, moving to respond to socio-environmental challenges of the near-future. These are mere words, as I now see them, far-removed from Tansley’s concept of the ecosystem as, “the system resulting from integrating all living and non-living factors of the environment.”² We plan to attempt such integration in special ways, to produce a lasting, working system of paramount importance to people of Earth.

We have benefitted from studying International Service for National Agricultural Research (ISNAR) briefing papers. We shall seek support to harvest progress of the International Agricultural Research Centers (IARCs), and use past efforts at “system levels” in agriculture. We intend to find pairings within soil unit, field, farm unit, farming landscape, catchment area, and agro-ecological region. We have planned uses (as others have attempted) for micro-scale **Alpha Units**, which we shall use within GIS maps to find and record agricultural and rural complex units for analysis and model-building.

² Tansley AG. 1935. The Use and Abuse of Vegetational Concepts and Terms. *Ecology*. 16:284-307. doi: 10.2307/1930070

The past has changed. Lamenting its absence and re-analyzing history seems likely to yield little. Grasses, for example—seemingly well-known to most people—are reported to be inadequately known by agronomists for their long-term persistence. Too late now! It might be classical agriculture to describe precisely the 325 biophysical regions of the US Department of Agriculture, but the funds, time, or interests are not available; the uses are not convincing—some say “regions” are too gross for meaningful analyses.

With anxiety, we generalize on “good land,” “prime land,” for that is the baseline for the future—lost to housing, airports, and other well-known human habitations. Worried, we study plant location, related to the fundamentals of nutritious plant growth needs (slope, aspect, growing-degree days, available moisture, and elevation, related to temperature and precipitation). We harvest the best knowledge available on generalized crop production, identify the location of the areas with such characteristics, and use GIS software to identify and map these socially invaluable lands as well as note those destroyed or no longer available. “Future value,” defined!

Rural System enjoys significant advantages over farmers who have struggled to stabilize crop production (and related family income). With resources from the Virginia Cooperative Extension, and graduating students from agricultural colleges armed with GIS and GPS, Rural System now may operate from a dynamic series of combined crop-system information sites.

We plan to work through available water, ownership borders, re-define “flat” areas, use importance-weighted slope/aspect/elevation Alpha Units, and then identify border zones and “special places” (e.g., fenced areas, roadways, etc.). We shall give full attention to maximizing valued-nutrients in the likely weight of named crop production per Alpha Unit, given locally-reported price-per-pound, and likely local crop waste weight. We shall work for local market value of *nutrients* (proportional to weight) in the volume of each crop sold. There is real pleasure (compared to the past) in making rapid computation of all of the above for each of several crops, changing yearly and over many years, with adjustments for tall-tunnel greenhouse structures, new local weather patterns, unusual crop predation, and new processing of weeds, pest influences, and crop waste.

We shall seek similar, existing software now before creating new software, to combine our crop-specific data files on Alpha Units with regional spatial, solar, and climatic data sources. We shall work toward having small water costs. We shall examine harvesting, storage, and shipping tactics, mixed with local delivery-to-market techniques and related costs, as we seek feasible, high net-value human-food crops. Net-value human-food crops may have low costs for collection, storage, and drying, low-energy cost for preparation, and “servings” high in essential, measured, nutrients. We seek bountiful, locally well-adjusted, high-nutrition crops contributing to diversely-flavored, tasteful meals.

We shall work toward discovering, shaping, and describing well all the potentials of the leased ownerships, within which we may grow and market crops. As we develop, we see the sum of all of our Alpha Units, 10m x 10m spots that we will get to know intimately. We are likely to have very large data sets or report-potentials for each, as we carefully engage their best uses. We shall work to gain high production from each Alpha Unit, and because we know each well, we are not likely to exceed their limits or expect too much. We recognize looming limits on each unit: the historic threat of a water crisis in 2030 AD, a phosphorus limit over its edge, and novel conscience that there will be no leeway in which to gain maximum likely profit on its tended-depths over time.

“Costly,” I can hear. I shall try to be brief. I believe I am at war now, quietly, but I prepare for human threats and their action on the deserted farm: changing markets; departing

workers; unexpected but well-known pests, diseases, storms, and misbehaving guests; changing crop values; broken fences; new taxes; changing, selfish neighbors; and wind-blown atomic-nuclide threats. Hungry urbanites are testing security at border edges while admiring the rural autumn beauty, as we wonder—without them—about the new possible sources of major nutrients for *our* food, because coal and phosphate mines are closing and sources are far way (and protected by gunners) ... giving a new flavor to “foods-hard-won.”

We’ll give a new price to water (amount, cleanliness, shipping, sourced from protected aquifers), and add it to food cost, along with human-terrorist and intestinal threats (those of ubiquitous, drug-based, novel water-pollution).

Staff will work to enhance a computer network, a nest of now-tentative lines among vegetable species and varieties available—select planting mixture used, age components, roots, delivery successes, purchased food, and aged waste. The network will also consider a processed component, processing energy and costs, waste, and will account for food discarded or unprocessed (i.e., due to disease evidence). The coded network procedures will include assessments of assigned palatability and personal (family or population) consumption weights, following processing procedures; probable nutrition ranges and weights; reported deliveries; probable multi-human consumptions; and overall costs per human life-day. All analyses will lead purposefully to local human health and wellness, as part of **Q***, **the quality of life index**, over many years (Chapter 11).

We may already concentrate on plant and food growth, but we often fail to mix with such study and work knowledge such as: more can be gained from cooking wisely than from wisely producing and buying family food. Rural System will seek to identify common sources of food waste, and identify strategies to reduce waste.

Resources for buying family food are needed, and Rural System may arrange resources for gaining money or its equivalents (e.g., hours of labor). Together we shall discuss and plan as we imagine and discuss:

- the home place,
- history and hope,
- food and the family, and
- water and wealth—the options.

The Rural System Alpha Unit will become known well, variation under control, and will likely be widely used for analyzing and prescribing, for maximum stable cost, suitable human food (nutrients emphasized) for the near future. We work to learn of companion crops, such as legume-cereal “intercropping,” gaining positive relations among plants for shade and structure, nitrogen gains, and moisture conservation. We shall explore the use of high-algae moisture additions, intensive pasture foraging for soil improvement, alternative-patterned forest stands and inter-stand patterns (as seen in agro-forestry practice), and pond-proximal stand cultivation.

Only with computer assistance can we likely achieve desired annual and long-term objectives from mixed crops, annually, over large rural areas. With expert help and data stored within **VNodal**, we shall seek to gain diverse benefits and profits from local gardens, many emphasizing differences intrinsic within area **clusters**.

We shall analyze the regional maps and what now grows within the boundary of each ownership using GIS/GPS, and we shall conduct roadside surveys to train Alpha Unit use based on our findings. We shall map and build data files about each Alpha Unit on all properties,

computing “cropland production”: a summary concept for all “lands,” excluding separate analyses for ponds, forests, wilderness, and roadside areas.

We shall subtract forested lands from the cropland production analysis, for economics will cast them as less valuable than those categorized as food-crops due to the time needed for tree-crop production. Then, we shall subtract all of the occupied areas, the land with road surface, those with dams, poisoned land, and lands on which it is impossible to grow and harvest crops. Some are too steep, too wet, too rocky, known to be barren, or lately poisoned... (We shall designate roadside areas as “polluted,” crops easily damaged, human-diseases uncontrolled, and crops likely impacted by waste along roadsides.) We shall include agroforestry crop-lanes. After subtracting, the lands left will be all we have for food production before nuclear and chemical contamination, full-scale exploitation. Our analysis will progress from all crop-land Alpha Units (i.e., all within a cluster, minus all inappropriate Alpha Units).

We shall study and report on microsite structure, and related costs and benefits of differences in temperature, light, local shadow, wind, lunar force differences, slope, aspect, elevation, and subsoil. Rural System will have identified and mapped such areas and found secure means for their preservation and best uses. Restoration and improvement work will recover some lands, and sunlit spaces may be used for artificial homes for plants, the plastic-covered green-house-like places, tall-tunnel houses, where prized food plants will grow.

All areas are dependent upon soil health. We shall attempt displays of the meaning of “soil health” and how to interpret it, and shall promote our healthy soil in marketing efforts. Rural System is devoted to displaying and teaching about sub-soil development. We shall study separately, and usually in parallel, a type of soil being formulated (selected and mixed) for diverse demonstration and sales/marketing attention: “**Vital Soilife**,” a potential Rural System product. We shall evaluate and show-off, as appropriate, our very diverse soil as a standard for various simplifying comparisons.

Rural System recognizes the importance and developmental potentials of pastoralism, as a production system and way of life, with increasing economic activity in producing milk, meat, leather, wool, and other products for domestic packaging, processing and consumption. Rural System may eventually apply intensive pasture management within climate-suitable areas, and grazing for understory suppression and site-improvement within some areas. Specialized Groups related to pasture and range will require a work force, and so will move counter to emigration trends and urban emphases, and engage questions of essential human nutrition elements to be produced per feasible unit area.

Early in Rural System development there will be no large livestock Groups. Large animals require intensive management and very personal attention ... and the people now continue to emigrate! Later in Rural System’s development, after structures, fencing, effective care, new pasture management and a stream of profits has been well-established, Rural System may launch livestock-related Groups for ownerships and select, small tracts that would benefit from them.

Rural System sees opportunities for producing work animals, animal wastes for plant growth, exports of live animals, and animal products (with foreign-exchange potentials). There may be novel potentials within agro-silvo-pastoral producers. New forms of fencing, handling livestock, and marketing products may alter local options and varieties of livestock handling (e.g., the valued pastoral beauty of managed grasslands in the tourism industry, and using goats to remove vegetation, thus removing extreme wildfire risks).

Only small farm animals (poultry, swine, milk-goats) will be suitable human-food animals in the future. A picture from China emerges; human success in the sculpted plateau lands is a hopeful demonstration for other lands of Earth, for there we may see future areas where conventional food supplies do not meet needed production. We may study using small herds of small, foraging goats within mobile, fenced areas to achieve plant and other desired characteristics for select, prescribed “plots” or Alpha Unit “spots.” Within such mobile activities, staff engage in erosion control, trail building, and watering-device repairs.

We know well the imperative of stopping erosion, but we know we must re-shape the land—all of it; soil-surface “injury,” if un-healed, spreads widely and quickly, like an infected wound. We have to find ways to restore mineral nutrients lost over the years from soil areas, with timely, well-distributed commercial fertilizers (notably of increasing cost), and “clean” wastes for our worm processing (composting) and diverse decomposition efforts.

We seek other food sources within ponds and streams, but find the costs of production, processing, and delivery of aquatic fauna to be very high. We study alternative foods, such as algae and insects, and study abandoned high-rise buildings for new food-growing surfaces (i.e., where there will be “experimental ecosystems,” because some human lands now seem unlikely to be suitable for high volume, mass production of food).

The Bees Group – Managing a Different Kind of Livestock

Keeping bees is a fascinating and profitable pastime that can be practiced in most areas of the United States, with relatively little trouble and a minimum of expense. Only a few dollars invested in equipment, a suitable location for hives, and an elementary knowledge of the habits of honey bees are needed to initiate a beekeeping operation. However, expert knowledge is needed, as with other “livestock,” for consistent, superior production and marketing.

Rural System’s **Bees Group** is part of the “land doctor’s” bag, as he or she explores the health of any rural ecosystem. Beekeeping is challenging, and successes or failures may better reflect the beekeeper than the bee population or their hives.

The honey bee (*Apis mellifera linnaeus*) is said to be humankind’s most useful insect. In the United States alone, they produce \$100 million worth of honey and beeswax annually, while pollinating more than \$2 billion worth of valuable agricultural crops. Animal-pollinated food products have been tallied to constitute 15-30% of US diets.

Insect pollinators of crops are often assumed to be “given” as a service to people from within nature. Yet, land use changes, climate change, invasive species, and diseases may cause a decrease in pollinators, their role in ecosystems, and the pollination service they provide. There is now a known decline in insect pollinator populations, caused by a lack of food sources, and the influence of disease and pesticides on egg laying, dispersal, and other diverse interactions.³

There are now abundant reports of bee hive population disease. Honey prices are high, and honey can be a valuable food and rural product. There are many local experts in Southwest Virginia, and the Cooperative Extension Service often offers published and personal advice. Within Rural System we plan to guard against bee pests and diseases (viruses and mites). We recognize the need for protection of hives from wild and domestic animals, possibly with electric fences, with the aid of Rural System’s **Fence Group**.

³ Vanbergen AJ. 2013. Threats to an ecosystem service: pressures on pollinators. *Front Ecol Environ.* 11(5):251-259.

Warming due to climate change may be a benefit (one of few) to raise bee colonies and queen bees for their roles; insects, being exothermic, are more active in warm temperatures. With many ownerships and variable elevations and protective tactics, a diverse quality and flavor can be created for significant marketing, branding, and profit gains. Climate change also increases weather uncertainties, and a new tactic must be developed to control hive moisture, which affects temperature and the likelihood of “mold” diseases.

We plan to diversify honey taste and quality, and market nationally and then internationally to key groups. Select management units will contain flowering trees within agroforestry lanes, with visitor/guest trails to come to learn, study, and experience our bees and honey. We expect wild fauna damage, shall work against it, and shall monitor attacks and evidence (displaying it in select areas for educational opportunities for visitors).

We propose (as basic to our business) an in-depth study of local forest and range pollination, abundance, duration, and life, as affected by the biotic and abiotic factors typical of regional land ownerships—especially noting ecological roles in grass-forb forest edges, the bee as prey of forest/field birds, the phenology of pollen abundance, the role of pollen within the complex soil ecosystem, and the effectiveness of bee hives stationed within tall forest canopies.

We shall develop products from local wood, including honey “spoons” for dipping, candies, poems, songs, and recipes. We shall invite studies of the reported first-aid and healing properties of honey.

There are 4,000 total bee species. We’ll be studying our local species for change and its effects on our total system success. The loss of proper, adequate pollinator interactions with crops may affect human food supplies, i.e., food security. We need habitat networks, reduced pesticide risks, and new therapies reducing disease within these pollinator populations. We need “approaches” to landscape-scale resource management, balancing the production of food and timber with pollinators, pest regulation, and water purification—among other management concerns explored herein—for resource security.

It is a peculiar logic, a dialectic, that separates the life forms of nature and discusses them not only as benefit providers (as done by economists) but as “service providers.” Services are inseparable from their providers, and usually providers are inseparable from their communities... and thus who gives and receives, provides and prospers, are inseparable among those usually bent upon discrimination.

Kremen and Ostfeld⁴ suggest that services may become so well-known and distinctive, that the ability to provide them may become known and managed for increase or stability. Yet, difficulties encountered in replicating or restoring wetland ecosystems is cited as evidence of the cost and near impossibility of reproducing or managing ecosystem services—poorly defined, poorly known—and that this fact is an incentive to *protect* ecosystems and their services.

Rural System’s Good Garden Group

Staff of Rural System study and work toward developing a **Good Garden Group**, specializing in superior garden products for guests to purchase.

Will our garden produce be “organic”? Widely used, in Rural System that term relates only to our own classification of “organic” produce.

⁴ Kremen C, Ostfeld RS. 2005. A call to ecologists: measuring, analyzing, and managing ecosystem services. *Front Ecol Environ.* 3(10):540-548. doi: 10.1890/1540-9295(2005)003[0540:ACTEMA]2.0.CO;2

Type #1 Organic in Rural System, means that the crops are from our tracts of exceptionally high-level organic-matter soils (>25%), those not treated with organic pesticides, and well-processed by our “herds” of native earthworms.

Type #2 Organic means plants grown in our highly-processed carbon-rich soil, with thrice-turned, GIS-selected, local vegetation mix.

Type #3 Organic means only that the produce was grown in conditions fed only with plant food bearing no pesticides, and that the final produce for sale is free of noteworthy pesticide residue.

Local means produce is grown and sold nearby, with minimum distance and fossil-energy cost of delivery to sale-place.

While USDA’s “organic” certification may be a useful and respected condition, we have learned that the condition is not profitable, the produce may not be of high quality, the public response is not widespread, the nutritional and health benefits are not clear, the results on the land are not well accepted, the wastes can be large, and the paperwork and filing costs are high. That’s more than enough to name a problem. The other part of the problem is that rules and regulations are not adequately monitored, and are subsequently not enforced.

From Berkeley Wellness,⁵ we gain a report confirming that organic foods are not more nutritious than conventional foods. Stanford University researchers’ review of over 200 studies, “found no significant overall differences in nutrients between organic and conventional fruits, vegetables, meat, poultry, eggs, milk, and grains - or in people consuming them, such as in blood vitamin levels or immune markers.” However, organic produce and meats were 30 percent less likely to have detectable pesticide residues than conventional ones. (One expert observed that there is no clear evidence that low-level residues in foods are harmful for consumers.) “Organic fed/processed meats were less likely to harbor antibiotic-resistant bacteria” than animal tissue of those with conventional diets. Antibiotics will be prohibited in our organic operations, partially because these contribute to the increase in anti-biotic-resistant infections in people.

We plan to develop information about our produce for buyers to describe our procedures, reasons, and expected customer benefits from our garden produce. We know, and share with customers in our publications and guest lecturers, that foods are only one part and function affecting a human's long-term health; other functions include genetic inheritance, diet consumed over a lifetime, total activity and lasting adverse event effects, environmental exposures, and infectious agents/vectors. The Good Garden Group will work with all of these elements, and invite guests and staff to learn from us their full meanings and effects.

We hold that our species-specific crops should be produced on the right soils at the right locations (growing season, slope, aspect, irrigation as essential, pollution free, etc.). They will be grown in Alpha Units, our unique, GIS-indexed spots of Earth. The meaning of “right” soils is being defined, and for preliminary work it means grown with minimum additional water, nutrients, or remediation, for an estimated proper-length growing season; with minimum environmental stresses (primarily water stress) potentially resulting from or correlated with insect, disease attacks, wind, or related physical damage; and minimum energy costs prior to consumption (planting, transportation, and preparation of a serving).

We have begun and are continuing to describe our objectives for the desired conditions of our crops as they grow. We seek a well-agreed-upon word or phrase for improved, profitable, long-term branding of our work and its results – healthy for the land, for the crops, the resources

⁵ Swartzberg J. 2012. The Right Reasons to Buy Organic. Berkeley Wellness [Internet]. [cited 2017 Apr 18]. Available from: <http://www.berkeleywellness.com/healthy-eating/food/article/right-reasons-buy-organic>

upon which they depend, and for the people that use them. For now, it's simply "Rural System's Good Gardens."

We believe that many of the lands with which we plan to work have been mined of their nutrients by past crops and harvests, and also by dissolution and leaching (e.g., the limestone and karst-topography), by sheet erosion and floods, and by livestock grazing and subsequent removal. We cannot expect such soils to produce for future people as they have for past people because the essential nutrients are diminished. We believe in adding the lost ones needed for superior, healthful, useful crop and tree growth. The nutrients we intend to add are documented, fundamental elemental minerals used by plants, many of which are used in the essential mineral processing systems of people. Thought costly, we will monitor the soil chemistry of our croplands and water bodies, collect food wastes from our customers, and, after processing, reunite the nutrients with the land for the people of the future.

We well-understand that nutrients can be added and that the proper amounts are needed to achieve a desirable cost-benefit condition. Yet, excessive applications to the land can be costly, even harmful, related to an important, intricate system. Mining operations for many major fertilizers are energy-intensive, and surges in energy prices (from any cause, hurricane or not), can increase producers' cost structure. Reasonably, that pushes up price of fertilizer products, expectedly causing farmers to decrease nutrient use and delay buying for future fertilizer use. Available nutrients then become a factor in deciding what plants to plant, influencing what cultivation methods and protection will be needed, and, full-circle, begin affecting the amount of costly energy that can or will be used to achieve profitability within the Good Garden and related promoted projects of Rural System. Rural System's crop profitability is therefore likely to be strongly influenced by quantities and bid prices on international fertilizer export demand, which influence prices of fertilizer products for our applications, which affects the amount we can purchase, thus drastically influencing the vigor of our well-placed crops and residual inventory.

As well as dealing with variable prices for nutrient applications, Rural System staff are well-aware of current and increasing surface and groundwater problems. We plan to irrigate carefully, fully aware of the continuing nutrient leaching that takes place on cropland soils. We shall capture and hold water, minimally using groundwater. We shall monitor these waters carefully and use the results to adjust the water use, soil amendments, crops selected, and the rates of removal and "binding" techniques being developed.

We are particularly aware (from reported studies) of the effects of plants being stressed. Those stresses create conditions attractive and/or beneficial to insects, and bacterial and fungal disease. These tend to produce preliminary discoloration or "spots" that significantly reduce the sale appeal and value of crops... if the crop itself is not destroyed before harvest. We shall carefully use biocides as needed to produce healthy food. That use itself is complex, and involves selection, carriers, timing, sequences, combinations, amounts, equipment, washing, delays since application, and transportation time and wind, temperature, and sunlight conditions... all within a system mastered by Rural System for **Healthy Crops** in lieu of "organic."

One of the ways that we shall reduce plant stress and thus crop-value reduction *and* the need for biocide uses (for crop pest or infectious disease control) will be to build superior soils. A key process includes crop rotation, which controls erosion, maintains or improves soil organic matter content, and manages deficient or excess plant nutrients. Sod strips, cover crops, green manure crops, and various mulches will be included in the rotation to perform these functions.

“Healthy Crops” is one of our phrases, denoting crops very beneficial for humans. There are some foods sold that have little nutritional value, and others that require large amounts of energy to harvest, process, prepare, cook and serve. There are some that are just too costly, said to be “not worth the trouble.” We plan to sell stable, healthful food, at lowest reasonable prices, from especially well-managed lands and waters, and with the food, we shall provide advice to make it useful to customers, i.e., to improve their health and that of their families, and to reduce wastes. We shall seek to be known for selling reasonably priced, “really good” food.

We study and work toward improving the following statement of a desired condition of hay and vegetable cropping systems. We call the desired “healthy,” meaning:

- Able to grow a primary plant community within a year and move along a recognized, diverse stage of transition to the next community;
- Offering only superior rural produce to customers/clients/guests;
- Maintaining a reputation for profitable production of tasteful, sparse-blemish, nutrient-high, reasonably-priced basic foods, consistently, for a very long time; and
- Using Rural System’s 150-year bounded production model, with “sustained” results sliding forward a year, each year.

“Sustained” has been and remains a smelly, wet, deep word-bog—a mire of unclear meaning. Rural System provides current understanding of the term “sustained,” and how it will be used to inform our future work and its profits.

Sustained –

1. a perceived condition, at a place and point in time, typically resulting after a series of actions, as in "after the project, the species was sustained";
2. within a human-influenced system, species or functions not yet extinct, extirpated, or destroyed;
3. a perceived condition persisting over a period, possibly with unstated (but needed) periodicity, fluctuation, and contingencies and constraints;
4. not permanent, but almost, as long as all of the conditions needed persist in quantity, quality, and sequence, and when interventions, if needed, are in place;
5. a past-tense verb, to have caused the condition of the system to exist for a stated period, e.g., by the combined efforts of A, B, and C, they sustained the production index of the region for over 30 years.

To sustain – The actions and processes that cause a system to be sustained. "Sustain" for how long? The life of a tree? A human life expectancy? Ten generations? An expression of an approximate period of concern seems needed, as well as the connotation of on-going inputs and processes. “Sustain” is a verb, generally meaning that a proposed or observed action should not seriously harm, impair, or significantly change negatively (or rarely positively) a structure, condition, process, effects, or output of a system.

Sustainable – An identified system having characteristics and conditions that allow the decided or specified condition of "sustained" to be achieved (1) ever, or (2) in some specified, implied, or policy-bound period. It means “able to be sustained.” Sustainable is a prospective noun, a condition, a processing state or status, e.g., the system may not now seem sustained, but it might be made or reshaped within a year to become sustainable. A system may be asserted to be sustainable at some level of operation (or implicitly "now") when some time scale, conditions, or investments are also stated.

Sustainability – Having conditions and forces that may allow, perhaps expressed with a probability greater than zero, a condition of "sustained" (as defined above) to be reached. Sustainability means the ability to maintain an effort at a given level or intensity, and an entity encounters difficulty if that "given level" is a declining rate (e.g., - 0.05 for toxicant removals or population rate of change). A word excessively and indiscriminately used since about 2002, sustainability has had use that was not sustainable. Flawed, the word or apparent concept behind it has no intrinsic lasting ability. Perhaps some systems have no sustainability; a negative is hard to prove.

Stable – Having a specific, usually limited rate of change (usually zero) over a specified period. The bounds or limits of that rate, if an estimate, need to be discussed and decided if the condition "stable" is to be asserted. A stable decline or increase matches the definition. A decline may be very stable for a period. A stable animal population of different sex, age, births, and mortality classes is a special complexity.

Static – A system in equilibrium with no net change of forces.

Having many meanings and connotations (and these are still debated), having a "sustained" system implies using practices and approaches that assure that it, the present system (or perhaps an evolved or improved one for the future), will persist. We want to know what "sustained" or "sustainable" really means in each particular situation, because we can imagine going to court and being confronted with the argument by some client that we have not sustained a resource, or that our work resulted in a condition (even if it was our intent) that was unsustainable (i.e., a very bad condition that should be reversed and made unsustainable). The subtleties can be missed by people who have not resolved the difference between words like "continuous" and "continual." (Some dictionaries suggest they are synonymous but the latter word may include recurring events, regular or not.) We have to say precisely what we mean in many situations, the more the better, because then we can build a strong conceptual structure as well as avoid the passing assaults of those who do not understand what we attempt to do.

"What has the future ever done for me?" quips a humorist. Sustaining good things into the future may be costly, and some people may not want to invest on behalf of those who will live then. Not so funny is the need to decide on a relevant time frame for any planning, and eventually to confront the issue of intergenerational justice, i.e., how can we decide on a criterion which, if met, assures us that we are behaving justly toward future generations?

It may be that assuring justice is a condition for sustainability of a social system. Without it, history is writ large about societies that have not been sustained, frequently disrupted by those believing they had been treated unjustly. Unjust or just, unfair-seeming because of the disproportional wealth of some people, organizations continue to bear the heavy burden of past decisions, wishing to avoid a sustained handicap.

A notable "handicap" condition exists... as we learn of whole human island communities endangered by sea rise related to glacier melt and rising sea water due to human-caused air pollution and climatic warming

In forestry and agriculture, it is well known that perfectly stable productivity is unlikely. Production practices change; nutrients are removed. Staff efforts in Rural System enterprises are directed to finding and being assured that they will have a desirable working system ... and to keep that, even when modified to address natural, legal, and policy changes. Actions are designed to meet changing human needs without degrading the environment or the natural resource base upon which achieving the objectives depends. Achieving the abilities and eventual condition of sustainability within an organization is treated as a dynamic, somewhat mystical

activity, allowing for and meeting shifting demands in combined ways that enhance future options for effective resource utilization.

It seems unlikely that we or other practitioners can prevent the loss of all threatened species in a state or region. Conditions have changed; some species cannot be sustained. We might do research and find out precisely why they cannot be sustained. What shall we do with such knowledge? Maybe they have no innate sustainability characteristics that allow them to face successfully the changed conditions of the world. Maybe funding to help those species was insufficient, though knowledge was adequate. Maybe knowledge was static, and no one knew how to use it.

Achieving sustainability is a false god, an open door to controversy, a sandy foundation for future work so badly needed. Simplistic publicists want a single word for their work. Those words selected were well-intentioned but too loaded with meaning and diversity to be useful now.

Work within Rural System over a broad area for the future will address arresting and reversing natural resource degradation. It will also address issues of declining crop productivity, and how to double food production over 25-40 years. Solutions are unclear, but for now, they include centralizing administrative and overlapping functions, coordinating, reducing duplications, using complementary practices, reducing competition, balancing endowments (money and resources), developing synergistic Groups, expanding the scale of select operations, and joining in setting priorities for project work and waste recovery.

Temporarily, all Groups will have access to specific, required GIS maps from the GIS Group. VNodal will use such data to achieve Rural System objectives of selecting crops and crop sites, building trails, expanding gardens, locating portable toilet sites, marking timber, establishing mowing patterns, scheduling pasture, making preferred re-seeding, building outdoor presentation areas, and developing sales media.

Each Group will order specific planning services from VNodal, e.g., growing tomatoes in an expanded garden beside a former home site. In the tomato example, three programs would be accessed, and will have been modified so that site conditions are separated from care and tending and regional blight probabilities. For another example, noteworthy flowering plants found at an old home site may be transplanted to a GIS-mapped, new site with best elevation in best shade with best soil conditions.

A **Modern Yards Project** will be started by four relevant Groups (including **The Gardens Group** and **The Yards Group**), primarily to reduce storm water loss, enhance groundwater, reduce mowing noise (**Earshot**) and fossil energy use (**The Energy Group**). The Modern Yards Project will plant flower gardens near impervious areas in former grassed yards, develop a small-version “Victory Garden” and do garden cluster marketing. It will use mob grazing (for soil nitrogen gains) by goats in mobile, electric-fenced yard areas; add yard sculptures; and gain certified status as having “fine fauna” places for diverse, year-around songbird enjoyment.

The Gardens Group

Rural System tends to respond to owners of small “farms” who are leaving rural lands for the cities, but it prepares for a major additional option—one of small land parcels of vacated farms being arranged for highway-access land-sale as home sites and “Hobby Farms.” There are about 70 million households engaged in gardening activities, or doing outdoor decorating.

Landscaping can increase the resale value of a house, thus there is a clear financial justification for landscaping work, both for those leaving and for those homesick and eager to see the changes. We have soil and ecological knowledge to back a landscaping or gardening enterprise. There is, in some areas, high county-level support for general services for dispersed tracts (e.g., water, access, waste disposal, schools, and safety). We shall work with the marketing potentials of such areas.

Owners are often swamped by demands for activities for “the front-yard” lawns and gardens for their new lots. “The backyard may be developed soon” is heard. A Rural System Gardens Group will demonstrate a principle of “economy of scale,” offering land owners, often who have purchased large lots, service-gardening within their backyards. Clusters of such garden areas will be studied and encouraged for their increased economy of scale.

The Gardens Group will offer owners a contract service to produce and manage beautiful fenced gardens on a portion of their home property. Much like a “lawn-service,” the Group will permanently manage, on each contracted property, a designed garden with flowers and garden foods, and achieve work-free management of the garden for the family. The Gardens Group may add lawn care, fountains and ornaments, diverse wild-bird foods, nests, and bird-baths.

Existing soils will be analyzed and then, based on conditions found, adjusted to an optimum standard of texture, organic matter, and fertility. Catchments will assure moisture in water-limited periods. The Gardens Group will work with other Rural System Groups, such as **The Pest Force** and **The Fence Group**, as needed. Fencing protects gardens from vertebrate pest damage and vandals.

Each garden will be specifically located with GPS coordinates, and a database with information on each garden will be prepared. Optimum seeds will be provided for the most profitable crops that can be produced on the plots within the specified location. Garden owners will be encouraged to achieve maximum-quality production, for they will earn additional income in sales of produce.

The gardens of all willing neighbors under contract will be managed in clusters, as if from a single regional garden, with advertising, cooperative sales, and marketing for all types of garden-related services and products (with partial financial returns to the landowners). Similarly, The Garden Group may invent, maintain, and enliven existing gardens for the general benefits of guests, visitors, and owners. The well-tended gardens, when abundant throughout the region, will give a distinctive look—additional charm and beauty to the area.

We must participate in growing and marketing the world food supply. The global population (that will reach 9 billion people by 2050 AD) will need food, and that must be increased by over 70% of today's production. Rising risks, fertilizer prices, and fossil fuel are all in the way of an already difficult task. Not only on highway-side tracts of absentee owners, or those with little time for gardening, The Gardens Group, working closely with other Groups when necessary, will offer intensive-use, computer-aided garden development—area-wide management of plant “housing,” soils, local compost, disease controls, theft protection, marketing, and water management.

Part of gaining human food, beyond that of estimating needed nutritional units for all healthful, non-wasting members of society, is gaining superiority over insect and related pest behaviors, and losses of plants to disease or harmful handling and storage. In addition to intensive animal behavior controls, other controls are needed for those in plant values with major alternatives gained by managing water; reducing wastes; selecting precisely-appropriate sites;

cultivating carefully; fencing; and simultaneously avoiding edges and trails, accidents, fires, theft, and terrorists' behavior.

Cropland Weed Control

Given expected, reported changes in weed elimination and control, we shall evaluate results from reported sites and study recommended treatments with site-characteristics known, including sequence differences in local applications:

1. Sequential weeding,
2. Sequential herbicide application,
3. Sequential shading (soil coverage, e.g., black plastic),
4. Heat-Rod application to early-adult plants. (Rural System's Heat-Rod is a concept to be studied for a well-heated metal rod that kills weed-plant roots.)

We shall combine other strategies for weed prevention and control:

1. Use of clean and vigorous seeds;
2. Selection of super sites for seeds (to ensure they will be strong competitors);
3. Use of space also occupied by non-weed species, and companion planting;
4. Continuing analyses of sites prone to weed growth;
5. Careful harvest and destruction of seed-bearing weed plants;
6. Two attempts at herbicide control, followed by alternative recommendations;
7. Aggressive, trained duck weed-seed foraging;
8. Broad-scale, timely moving to reduce seed dispersal;
9. Modest, timely weed removal and destruction;
10. Use of rural system wind barriers to reduce seasonal seed/weed plant dispersal; and
11. Required seasonal use of boot covers for guests entering garden areas.

Fencing In and Out

The Fence Group will provide land and watershed protection, but also a powerful managerial tool silently guiding people, animals, vehicles, and visitors' eyes to historic landscape beauty, protecting growing food supplies and providing solar-electrified protection for bee hives from bears. The Fence Group of Rural System will play a large, growing role within land management of all types, from studies to assistance in protecting crops from unplanned animal use. Crop loss prevention is a key challenge to overcome in Rural System's work toward increasing and stabilizing human food supplies for future people.

The Group will design a visually distinctive set of very suitable fence types that will contribute to the rural character of each county. It will develop an efficient procedure for installation, create horse and other pasture fences, and specialized fences for gardens, beehives, and rabbit housing protection. It is likely that signs for Rural System enterprise environments, **Dogwood Inns**, cemeteries, and various other Rural System sites will be created in this Group. Local woods will be used for fences and signs at some sites. Notable but compatible colors will be used, as well as minimum wood preservatives. Bird houses will accompany almost all Rural System fences, for wild fauna as well as functional benefits. Nested hexagonal pastures will be

used in rotating grazing to areas rested from use, and for creating unusual patterns on the landscape. Lay-down fences will allow maximum soil rest rotation and mob-grazing strategies.

Flagpoles, with locally-made colorful flags, will typically be placed at two corners of each fenced pasture. Undersized wood will be thinned from forests to supply fencing and to improve forest stand quality. Special efforts will be directed at stream and pond bank fencing to reduce erosion and to improve riparian water volume conditions. Abundant fencing will be needed throughout each property to allow for livestock management later, though livestock management is not planned for absentee-owned lands if caretakers are not present. The Land Force will likely be otherwise very busy for the early years of management. Later, livestock may enhance rural beauty and atmosphere, and aid in soil improvement through intense, fenced-grazing. Stone walls, or fence combinations of stone and wood, especially for contoured areas, may be appropriate for some livestock and trail sections.

Abundant, low-quality wood often exists on areas within the region. In this planned enterprise, a log splitter can be used to form or split small fence rails. By immersing them in a gas-, coal-, or wood-heated vat of preservatives they can then be used area-wide or bailed and moved by rail or truck to urban centers for sale, for yards, estates, and farms. The preservative properties of daffodils, Eastern cedar, Christmas ferns, common moss, black locust, Ohio buckeye, and walnut hulls (from the Walnut Vales Group) will be investigated for use with bio-preservation substances.

By careful, planned use of a unique fence style, the image of the region and the corporation can be built and enhanced. Visitors may so admire the fences they will order them for their property. Guided employment and salaries will be noteworthy.

Consistency of style and evident "fit" into the planned appearance of the total property will be necessary. An architectural review panel will be consulted for fences as well as other Rural System structures. They will have the responsibility of deciding on or approving paint, color, texture, proportions, materials used (stone, glass, wood, etc.), and otherwise assuring a high-quality visual experience for visitors and one that enhances the life quality of the residents.

Deer damage has reached unacceptable levels in some areas. Work with **The Pest Force** is one option that will likely develop, but a separate subproject of The Fence Group may develop a cost-effective, high, out-rigger fence for protecting nurseries, crops, and high-valued landscaping. Solar-energized electric fencing and repetitious use of repellents (as from a lawn mowing service) may also become part of the supplies and services provided by The Fence Group.

Significant fencing literature is available from county cooperative extension offices. There are experimental designs for outrigger fences related to gardens and select landscaping zones within cities and border areas. Fencing limits will vary, and extensive public inputs may be needed for large-area satisfactions.

Homeowners may wish to keep deer out of their property areas. Some also wish to allow dispersal of other species (e.g., turtles, bobcats, canids, etc.) across the landscape, now blocked by some highways and structures. However, if the current trend of installing deer fencing continues, a town or area may become a collection of isolated habitat islands. Instead, we shall continue to search for a "magic" fence that acts as a semi-permeable membrane, filtering out deer, while allowing other species to pass through. Extensive fencing of our landscape is undesirable but here to stay. We must find a way to minimize the impacts of fencing or to change animal behaviors, a combination, or consider a de-valuation of the animal or its effects.

The Fence Group may use fences to move animals away from (or toward) photo areas, toward hunter blinds, or to particular areas for observation and image gathering. Staff are likely to explore increasing and controlling the wild faunal values present, with blinds for wild fauna watching, animal feeding, using highly-visible electric-fencing, and select locations for organic repellents. Controlled culling of deer by expert teams now seems a reasonable solution to a now-growing problem within rural areas in the absence of native predators.

In towns or built-up areas, shooting at garden pest mammals or birds is dangerous or illegal. There are usually people or animals in the background. People usually only try trapping animals attacking a garden after damage has already occurred and been noticed. The losses may be great; large deer populations now damage crops.

Garden animal pests are a big problem and a fence may be a solution, i.e., calling a vertebrate pest damage manager such as those planned for The Fence Group and The Pest Force. Electric fences with solar power sources may offer adequate behavior control.

Integrated Pest Damage Management

The Pest Force is a planned, integrated pest damage management enterprise within Rural System. Its function is central to the sustained profits of Rural System's work with land owners.

There are poisonous snakes. Gardens or crops are eaten by deer. Woodchucks get into gardens; bears destroy bee-hives and sheep (and in some areas, signs and tree saplings), birds eat grain; raccoons get into young corn; foxes kill poultry... and bats frighten some people. Reducing real, significant loss within a total production system is an objective of modern Rural System management.

The Pest Force will exist to meet the needs of citizens, corporations, and agencies. It is planned to be a private, for-profit corporation seeking to improve comprehensive, total system management with other Groups of the Rural System.

The Pest Force will concentrate on damage, not necessarily on the animal apparently causing it. It will seek to reduce and manage that damage in legal, humane, and cost-effective ways. Their analysis of costs over time will use a combination of methods, often selected with the aid of a VNodal program, to gain an optimum strategy of damage management. The land owner may implement the selected and recommended strategy independently, or may obtain Pest Force services to do so. Fees will be paid for the visit, analysis, and implementation.

Profit need not be made exclusively from product and service sales. A *net* return is achieved in profit; reducing losses is fully as essential as improving gains. In some situations, wild fauna may become a pest. There are various definitions of "pest," but herein the emphasis is on reduced or limited benefits and costs of money, time, equipment, future tree or crop growth, and quality of recreational and outdoor experiences. The emphasis in Rural System is on the lost benefits and costs, on the damage, not the animal, but the productive system.

In some cases, the pest may be an insect species—an herbivore susceptible to chemical application. In a recent book, *Integrated Pest Management of Tropical Vegetable Crops*,⁶ the author assembled the factors likely to be faced by The Pest Force and others in the complex decisions dealing with insect pest control. The number of factors is impressive, challenging and persistent, making repetitive use of computer aids necessary and worthwhile. Among available control methods, cost comparisons are needed, as well as consideration of: timeliness, land

⁶ Muniappan R, Heinrichs EA, editors. 2016. *Integrated pest management of tropical vegetable crops*. Springer Netherlands.

treatment, crop value, labor available, local laws and changing regulations, shipping available, freshness of harvest, control substances available, targeting of control applications feasible, control substances' effectiveness, and local markets attitudes toward substances found locally suitable for chemical control of insect damage to crops. Managers must also consider ever-present, harmful climatic/weather events before or after chemical application.

The methods of control will thus depend on the pest species threatening Rural System enterprises (which are furthermore not limited to crops). Rural System will focus on preventing damage, and may not rely heavily on chemical control. VNodal prescriptions of the best sites for crops or trees and their density will likely reduce the need for chemical control in some cases. For example, trees that are not water-stressed—that are spaced adequately to reduce competition between individual trees—will not release the chemical signal that resembles the reproductive pheromone of the bark beetle. Trees that are not stressed or dying should therefore be less likely to attract and succumb to bark beetles.

In other cases, the pest may be an animal species. The Pest Force is not a group of trappers (though trapping may be the only cost-effective, legal, safe, and timely response to a disease-related or fierce animal problem). Its trained staff is willing to work in often-dangerous conditions in order to solve people's immediate, often costly problems. Many of the problems are not those of direct financial loss, but of lost quality of life, sleeplessness, fear, annoyance, and uncertainty.

Trapping is a special skill and requires site-specific and animal-specific equipment and licenses. Live trapping is often illegal. Killing and removing an animal from a live trap can be illegal and dangerous. It is illegal in most places to release the animal other than where it was trapped, for it is socially irresponsible; animals often return over great distances, and the potential crowding at the release site causes stresses and does not help the wildlife populations at the site. Very often the offending animal is not captured.

However, we see trapping as a part of the nation's history. It was a part of settling the land; protecting people, livestock, and cultivated areas; and obtaining food and clothing in early pioneer days for rural people. Today, trapping is part of a diverse international fur, meat, gland, and medicinal industry. It is an economic mainstay for some, and a source of extra income for others. It has rarely-assigned recreational value.

To operate a trap line is hard work, but it provides an opportunity to be outdoors. Given success in so many areas, “pest” control has become a necessary activity for farmers, ranchers, orchardists, and increasingly for people in cities affected by wild animals. Trapping may be the only practicable means for controlling damage to the land itself. Skills in trapping are fundamental to sampling animals and to obtaining information for decision making... or basic knowledge of animals, habitats, or behaviors. It is used in some types of disease surveillance, notably rabies control efforts.

Trapping is said to be a recreational activity for some people, but we view it as very costly of participant time, having too many probabilities for consistent, planned payoffs and meaningful successes. As it was with pioneers, it may be essential for survival for some families. We shall work to produce a high ratio of benefits to costs, with minimum personal and group displeasure. The same animals sought for trapping may often be seen by visitors and guests, adding to the diverse, pleasant, rich experiences of those visiting Rural System lands and waters.

Continual work is underway on improving traps and trapping procedures, gaining quick kills, protecting each carcass, and rapidly recovering animals taken by traps. Modern trappers control costs or losses, and use of effective traps (by many criteria), are part of modern vertebrate

animal *damage* control. Research and invention is underway on traps. Over 4,000 patents on traps or trapping devices have been issued over 100 years. There is great interest and concern for better traps, though the leg-hold and conibear remain popular and effective. Difficulties with traps are rare and usually associated with poor trapper procedures, not the trap itself.

We anticipate using trapping to influence crops directly; buildings; animal forage; game-bird-breeding experiments; perceived risks to guests; non-migratory birds affecting experimental crops; predator effects on stock and their profitability; predators on pond fish, their monthly weight removed and angling success; and birds-of-prey within special studies related to woodland-mouse production (related to bobcat, fox, raccoon, skunk, and opossum population foraging studies).

Specific recommendations within the Rural System programs and projects related to trapping are:

- to encourage superior trappers, largely through employment of certified, successful and well-trained experts;
- to continue to develop analytical techniques to relate pest-species-specific individuals', populations', and migrants' estimated effects over time on rural product profits;
- to set traps outside of areas or under conditions in which domestic animals may not be caught or harmed;
- to check traps regularly, at least once a day, and in the early morning;
- to label all traps and devices;
- to achieve balance with estimated desired effects on animal populations and desired crop production or "target" amounts;
- to engage in studies, and to improve animal behavior-control techniques by several criteria (e.g., fences, containers, repellents, crop substitutes, attractants, frightening devices);
- to continue to support improved recognition of animal damage causes, population size estimates, and detailed estimates of physical and monetary losses related to wild animal populations;
- to use effective traps as needed, some that kill targeted animals very quickly, and some that trap animals harmlessly;
- to support continual improvement in traps and trapping systems to increase their effectiveness and social acceptability;
- to dispose of animal carcasses properly, preferably for beneficial secondary uses, and at least so as not to offend other people;
- to concentrate on animals perceived to be of pest status or predators of domestic animals;
- to offer trained hunters opportunities and procedures for effective removal of vertebrate pests;
- to support strict enforcement of pest-animal-related laws and regulations;
- to support educational programs, both for trapping effectiveness and for allowing trapping as a tool to achieve many wild faunal resource objectives;
- to report promptly the presence of diseased animals to authorities; and
- to maintain records for improved faunal predator and prey resource management.

As may be sensed from the above list, there are many potential commercial activities that, working together for scale and scope, can become profitable within The Pest Force—essential in

protecting ever-increasingly valuable, high-quality, nutritious food supplies for human populations gaining the verge of 2050 AD.

Sensitive to human regard for life and treatment of animals, The Pest Force is also realistic about the threats related to animals infected with rabies, West Nile virus, tularemia, leptospirosis, encephalitis, psittacosis, and recently black plague. The interaction of the fleas of cats and dogs to those brought to them by mice and other animals is well known. Wild animals are reservoirs of insect-borne diseases.

The Pest Force will offer an effective program of town and neighborhood rat and mouse control. It will be equally responsive to select needs of people with immediate and long-term solutions, household and corporate, for problems with bats, moles, snakes, geese (e.g., golf courses and agricultural grain fields), woodpeckers (noise complaints and damage to exterior walls), feral cats and dogs, squirrels, gulls (airports), starlings, skunks, muskrats (pond dams), and garden pests. The Pest Force will offer effective deer management strategies in cooperation with **The Deer Group**. A specialized program for beaver management may be developed for **The Beaver Group**, one including beaver removal, tours, education, anti-preservationist work, publications, damage assessment, legal assistance, and integration with forestry and fisheries.

The Pest Force, backed by VNodal, will continue to build a database and report-system, and provide every customer with unusual information about each relevant species with pest activity. An effective Pest Force blog is planned, featuring pest species, young and old, and tales of the animals' ecology—food, living quarters—all for desirable marketing and Group branding, concentrating on financial loss-prevention and -reduction.

In some cases, research will be needed, but Rural System advocates a rationally robust strategy (Chapter 6), and sophisticated, commercial "expert system" software (Chapter 4). When research is needed, The Pest Force may work with students and faculty at Virginia Tech and elsewhere, providing employment and experience for students, and research and project options for graduate students and faculty. The animals involved in the work of The Pest Force will be measured and scientists will use results to learn more about the animals and effective control of their actual or perceived damages. Unique problems *do* occur, and the staff, with a taskforce, will attack such problems.

As in other aspects of Rural System, records will expand knowledge of animal distribution. The Pest Force will offer GIS analyses through System Central and The GIS/GPS Group. One recurrent theme in damage management is that the wrong crops (or other things of value) are put in the wrong places. "They could not have picked a worse place!" is often heard after loss to a foraging animal is seen. GIS can help developers avoid problems by selecting the right or "least bad" spots for crops, livestock, buildings, etc. GIS can help explain problem causes, identify trends, and project future problems as land uses change due to ecological succession or urban sprawl.

The Pest Force will offer unusual architectural design services. Major pest damage problems arise in faulty design. Simple changes in building construction can avoid costly damage reduction work year after year. A question-answer software unit will allow contractors, developers, and architects to solve some of their own animal damage design problems. Personal advice from staff will also be available, because the software will not likely address unique structures adequately.

Furbearers are a group of animals with great appeal and with unexploited financial potentials for intensive management. A rich variety of these animals lives in the Southwest Virginia region: raccoons, beavers, weasels, skunks, mink, and others. Furbearers need

management already, since they cause damage and can compromise other management objectives, but they can also be changed into parts of a profitable managerial enterprise: **The Furbearer Group.**

Much research has been done on them, but much, much more is needed and few people realize the complexity and relations of their system. The need is for some of the most intense, far-reaching research anywhere in the world. It should not only be on the biology of the animal (the past trend), but on the total profitable enterprise.

Agencies have waited for funds, but none to our knowledge have stabilized an intensive management system including standback, Context, feedback, futurism, and feedforward. The prospects are not for recreational trapping (strongly opposed by some), but for a viable, profitable enterprise utilizing some of the well-managed, non-threatened mammalian fauna, one of the natural products of the area, in ways no one else has been able to sustain in the past.

The laws that relate to controlling animals are now very complex. Trained, certified, bonded staff can avoid these issues, adding further to cost-effectiveness and increased value of services provided. Expert testimony can be provided. The Furbearers Group and The Pest Force of Rural System, as all other Groups, aspire to high business standards, leading to known standards of business excellence, of opportunity, fairness, and personal integrity.

Rural System's approach to high-quality and quantity food production to feed growing populations, in anticipation of the 2050 AD food crisis, is an extremely complex system. In Chapter Three, we sketched the main components of Rural System food production, which includes but is not limited to:

- Alpha-Unit-specific precision management of crop placement, nutrient additions, erosion control, companion planting (i.e., permaculture), irrigation, etc.;
- Small animal livestock, such as goats and chickens;
- Bee "livestock" to provide stable pollination for Rural System crops, as well as various bee-related products (e.g., honey, honey spoons, and beeswax products);
- A new concept of "Healthy Crops" rather than USDA's Organic certification;
- Carefully defined and challenged use of the word "sustainability," and related terms;
- The Gardens Group, providing precise garden management on the properties of remaining rural residents, to supplement larger-scale production of food on Rural System's enterprise environments and to contract sales to rural border customers;
- The Fence Group's work with a variety of fencing styles, both for esthetic benefits of accentuating landscape aspects, and functional benefits of pest animal damage management;
- The Pest Force Group, working with The Fence Group to provide pest damage management, but also engaging in limited trapping activities to control pest populations; and
- The Furbearer's Group, which may sustain a novel enterprise in legally trapping furbearer animals for diverse meat- and fur-products.

When unified, the many components listed comprise a novel, holistic, and systematic approach to stabilizing rural food systems for healthy human populations. We continue to ask for reflection on our objectives, none of which is "maximum profit." We have consistently said that

Rural System is not a high-yield, high rate of return enterprise, and thus typical angel investors have not expressed interest. Rates of return seem small, and observers are invited to consider planned scale of operations... Are they less costly than to send fruits to market?

The evidence is in: traditional farmers fail and are moving from rural to urban areas. Superior and extended farm work without salary, little innovation, unavailable off-farm family workers, and land inheritance issues together destabilize farm life. The well-known “small farm” cannot likely be recreated in its traditional form now as a food base; a food-export source; a community financial base; or as a safe, healthy, well-educated, lasting-family home. Widespread, water quality and quantity are now threatened. Absentee owners have little information about agricultural agencies or their services. An estimated 63% of absentee owners (mentioned before, the new and likely emigrants) have never been farmers.

Fewer than 2 percent of Americans farm for a living today⁷; only 17 percent of Americans now live in rural areas.⁸ People now leave farms in Virginia. Some are aging, infirm, and even though rural medical and assisted-living services are present, adequate transportation is lacking. Agriculture is within the topmost-dangerous occupations. Affordable, rapid access to health and medical services and centers must be stable as regional needs increase. In 2012, the average age of a principal farm operator was 58.3 years, up 1.2 years since 2007, and continuing a 30-year trend of steady increase.⁹

Farms cover 8.3 million acres, or about 32% of Virginia's total land area.¹⁰ Much of the rest of Virginia's land is covered by buildings, highways, and airports. Absentee landowners (emigrants of all types) own an estimated 45% of agricultural acreage in Virginia.

Nearby where I write within western Virginia, there are more than 300,000 acres (variable criteria throughout) of absentee farm land, an estimated initial market for Rural System services. The current average farm size is 180 acres.¹¹ Small farms and ownerships in Virginia are marginal (family income below the poverty line) and “success” is tallied by some as related to international trade conditions. Eight percent of farms account for 85% of farm sales.¹²

Rural housing quality declines. Absence of broadband for high-speed internet work now limits business and education growth for the region. Threats of fossil energy shortages and local limitations abound; critical knowledge is absent—that agriculture is highly energy-dependent.

Active strategies to respond to harmful shifts in climatic temperatures and growing seasons are only slowly forming. At national and international levels, diverse, timely, large amounts of food and organic products are needed to feed an expanding human population by 2050 AD. Unbelievable! I claim grounds for action.

The 2013 United Nations Conference on Trade and Development Report Summary states that small-scale, diverse systems of food production are the only way to feed growing human

⁷ USDA. 2017. 2012 Census Highlights. Census of Agriculture [Internet]. [cited 2017 Apr 19]. Available from: https://www.agcensus.usda.gov/Publications/2012/Online_Resources/Highlights/Farm_Demographics/.

⁸ Council of Economic Advisors. 2017. Strengthening the Rural Economy - The Current State of Rural America. The White House [Internet]. [cited 2017 Apr 19]. Available from: <https://www.whitehouse.gov/administration/eop/cea/factsheets-reports/strengthening-the-rural-economy/the-current-state-of-rural-america>.

⁹ Ibid.

¹⁰ USDA 2017. 2012 Census Volume 1, Chapter 1: State Level Data—Virginia. Census of Agriculture [Internet]. [cited 2017 Apr 19]. Available from: https://agcensus.usda.gov/Publications/2012/Full_Report/Volume_1_State_Level/Virginia.

¹¹ Ibid.

¹² Ibid.

populations of the future. “We need to see a move from a linear to a holistic approach in agricultural management, which recognizes that a farmer is not only a producer of agricultural goods, but also a manager of an agro-ecological system that provides quite a number of public goods and services (e.g., water, soil, landscape, energy, biodiversity, and recreation).”¹³

We may assist the region in meeting part of those needs with an alternative strategy, integrating sophisticated, diverse, computer-aided land use actions conducted by a very diverse, for-profit business corporation, i.e., Rural System. We predict success and a modest, stable, bounded profitability for the system while it achieves its other, closely-related and co-dependent objectives. The destination is much clearer than the pathway to it. I write to clarify the well-hidden paths to that challenging condition that must be reached soon.

You are now reading about the alternative to the present, rapidly-forming, very troublesome conditions. That alternative is a well-developed Rural System, existing within the same lands and waters of the present, but differing in many ways by their great diversity, emphases, productivity, resilience, reliability, and gainful linkages to other lands and waters in clusters—*all working, computer-aided, land-character computer-mapped, toward common, long-lasting financial gains*. Within Rural System, collaborating small businesses will emerge in these rural settings, using research results and high technology in novel ways to improve rural conditions ... and to produce food and water for healthy, educated people, very soon.

¹³ United Nations Conference on Trade and Development. Trade and Environment Review 2013. Wake up before it is too late: Make agriculture truly sustainable now for food security in a changing climate. Geneva, Switzerland. UN Symbol: UNCTAD/DITC/TED/2012/3.

About the Author

While many Americans are presently astonished at conditions in rural America, Robert Giles, Jr., Ph.D., has been working tirelessly for decades on planning solutions to interconnected rural problems. Dr. Giles is a Professor Emeritus of Wildlife Management at Virginia Tech where he taught for 30 years. His Bachelor of Science degree in Biology and Master of Science degree in Wildlife Management are from Virginia Tech. His Ph.D. in Zoology is from The Ohio State University.

Dr. Giles was born on May 25, 1933 in Lynchburg, Virginia. He attended E.C. Glass High School, during which he was awarded a Bausch and Lomb Science award for studies of the ring-necked pheasant. As an Eagle Scout, he was awarded the W.T. Hornaday National Award for Distinguished Service to Conservation and the James E. West Scouting Conservation Scholarship. During his undergraduate years at Virginia Tech, Dr. Giles was an editor for several magazines and the president of the V.P.I. Corps of Cadets of 6,000 students. He was also a member of seven national honorary societies.

During his time as a Professor in the Department of Fisheries and Wildlife at Virginia Tech, Dr. Giles was known for his innovative applications of computer programming and Geographic Information Systems (GIS) to land management questions well before such skills became standard practice within the field (and before GIS was a term). With the support of the Tennessee Valley Authority (TVA), he created the woodland resource management system of TVA, once used on 300 farms a year. With staff and students, he created the first wildlife information base (BOVA – Biota of Virginia database). As chairman of a local planning commission, consultant to the National Wildlife Refuge System, aid to the State Cooperation Commission, consultant for Wintergreen and several realtors, and as a landowner himself, he has developed a unique and alternative perspective on land and its management. He wrote the first plan for wildlife other-than-game for Virginia.

Dr. Giles began working on the Rural System concept in the early 1980s, but did not begin in earnest until his retirement in 1998. When asked about his aims for designing Rural System, he said, “I am now convinced that a superior demonstration of modern comprehensive natural resource management is badly needed and is now possible and most likely within the context of a new corporate rural structure. I do not want to do research. I do want demonstrations of the results of literally millions of dollars of unused research findings. I propose to bring all the power of the computer that I can to realistic and relevant use for parts of the region. This will include using that power already achieved by investments of resource agencies. I propose a system, subject to the law and to reasonable issues of cost, propriety, and community acceptance, that achieves such objectives.”

A colleague of his once said that Dr. Giles can come up with more ideas in an hour than most people can in a lifetime. His creativity is exceeded only by his humanity. Raised in Southwest Virginia, Dr. Giles knows the struggles of people in Central Appalachia, impoverished after the collapse of coal and tobacco industries. He has visited rural areas of Africa (Nigeria, Senegal, Uganda), China and India, and is well-educated in the sufferings of people in poverty worldwide.

Dr. Giles is a systems thinker. He believes that the problems faced by environmentalists and those of interest to humanitarians are interconnected, and that a system of problems must be met with a system of solutions. His career, his values, and his innovative capabilities make him

uniquely suited to tell the story of how a for-profit systems approach can best solve the rural problems of a progressive, capitalist society.

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