Ecological Economics, 3 (1991) 181–191
Elsevier Science Publishers B.V., Amsterdam

Commentary

139

Holistic resource management: a conceptual framework for ecologially sound economic modelling

Allan Savory
Center for Holistic Resource Management, P.O. Box 7128, Albuquerque, NM 87194, USA

(Accepted 30 October 1990)

ABSTRACT

Savory, A., 1991. Holistic resource management: a conceptual framework for ecologially sound economic modelling. *Ecol. Econ.*, 3: 181–191.

Economic modelling that enables us to make better decisions and plans is complex because of the multi-dimensional relationships involved. Underlying the need for workable models lies the foundation of how people make decisions in managing their resources. There is an underlying subconscious model which has been used by mankind for thousands of years and which has become the mainstrean scientific management model. This is illustrated with the reasons why this model cannot reverse desertification. Desertification has led to the downfall of some 26 civilizations, no matter how they measured their wealth or managed their money.

A new holistic model under development is described. This model is proving successful in that desertification is being reversed even in drought years and people are experiencing more prosperity through improved decision-making. This model is enabling us to analyse major resource management policies simply and with a high degree of confidence. Both at a farm level and at a national level we are able to detect major economic mistakes which were undetectable with the mainstream scientific model subconsciously used by economists. This holistic model is seen as a possible foundation on which to build successful economic models. Others are invited to become involved in its expanded development.

INTRODUCTION

Today, a bewildering array of success and failure surrounds us. As we probe into this confusion an interesting picture emerges. All of the successes

0921-8009/91/$03.50

are in the artificial manmade world of technology which is mechanical in nature. This fits with our prevailing mechanical scientific, economic and ecological paradigm. When we look at the areas of failure, already apparent and looming, we find all lie in the area where things are not mechanical – the real or natural world of multi-dimensional relationships. Thus we see astounding success in space exploration, communication, computer technology, household comforts, transport and such endeavours. But in the natural world, we see mounting failure as deserts expand relentlessly, global weather changes, agricultural practices cause one civilization after another to collapse, wildlife disappears, diseases rise and forests and lakes die.

Between these two areas we find one field entirely of mankind's making, but which is multi-dimensional in nature and running into increasing problems: economics.

An organization such as ISEE has come into being because of this dilemma and the realisation that our current economic concepts and management models are inadequate. Apart from economics being a multi-dimensional field, it is without question linked in the long run to the 'capital' of millions of years accummulated in the soils and living communities that sustain mankind.

For future economic modelling to be sound it is increasingly apparent that economic ideas will have to be tied to the realities of the process of biological succession[1] which sustains all life and civilizations. No matter how kings, generals or pawns measured their wealth in the past civilizations that succumbed to the spread of deserts, once the biological capital of the surroundings was exhausted, all failed.

We have at least two complexities to deal with before any economic modelling can truly be sound. On the one hand we have the formidable task of developing workable models in complex multi-dimensional situations. On the other we have the ultimate tie of economics to the basic health of our ecosystem which is deteriorating over most of the world. From the fact that deserts continue to spread in America and elsewhere, despite our scientific endeavours, it is apparent that the mechanical paradigm underlying our scientific model of resource management is faulty.

It is on this problem of the basic scientific model that I have been working for the last 30 years. During this time significant strides have been

[1] Succession is roughly biology's answer to entropy – a thrusting up as opposed to a running down, the irrepressible striving of living communities to become more dynamic, diverse and stable. This is the force that causes jungles to overgrow old civilizations in areas of perennial rainfall, and soils to form from lava flows. It is the process that provided the biological capital we now use and which maintains the air we breathe.

made by myself and many others and it is my hope that this progress can be used by economists to save time, cost and duplicated effort.

Economists, and businessmen have long seen the need for the use of models in complex decision-making and planning. Because the soil, air, plant and animal life was seen as simple for thousands of years, biologists and ecologists such as myself did not see the need for models for management until recently.

Most people are not aware that we do subconsciously use a simple management model in our work although we never consciously saw the need. We do this as practical farmers, wildlife managers, foresters and also as scientists for managing everything from small farms to global warming and desertification. The basic scientific management model is depicted in Fig. 1.

The *Goals* referred to in Fig. 1 include: production volume, reduction of problem plants and animals, preservation of species, problem solving – soil erosion, insect outbreaks, global warming, etc. The *Resources* include: soils, seas, lakes and rivers, animals, plants, minerals, fossil energy. The *Tools* include our creativity and money which are applied through: technology (in all its forms), fire, and rest (from livestock or crops). The *Testing* is based on the following questions: Is it profitable? Does it cash flow? Is it cost effective? Does it provide the best gross margin? Is it traditional? What do

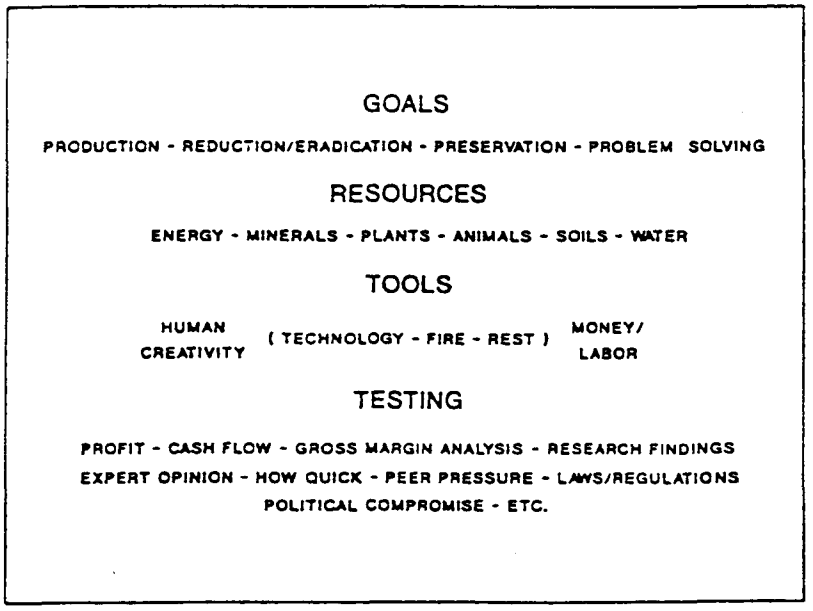

Fig. 1. Scientific management model.

our peers think? Is it a satisfactory political compromise? Is it supported by research? Is it socially acceptable? Does it satisfy regulations and law? Does it clash with past experience? and so on.

In recent years there have been adjustments to this model. In American agriculture in particular, people have introduced the idea of sustainability into the goals and testing questions. They have also introduced the idea of living organisms in the form of 'friendly plants and insects' into the tools available.

The complex computer models being developed for resource management have the same underlying foundation provided by this subconscious scientific model. They have an additional factor which I see as a problem. Because the human values, cultures and feelings critical in management cannot be programmed, they are left out.

There are a great many problems facing contemporary society but two are paramount. If they are not addressed, the others will not matter as we will become extinct. The two are desertification and global weather change, both results of ecosystem malfunction or damage. As poor land means poor people, social and political unrest and upheaval, both problems are irretrievably bound to any future economic concepts we develop.

I refer to desertification as the steady loss of biological mass and diversity on land or in water. Its common symptoms are:

(1) Soil erosion and eventually sand dunes in arid areas.
(2) Increasing frequency and severity of both droughts and floods, even with no weather change.
(3) Rising outbreaks of disease, problem plants and animal organisms.
(4) Rising poverty and human conflict.
(5) Alteration of the composition of atmospheric gases and consequent weather changes.

The changes in the composition of atmospheric gases that have interfered with earth's temperature control mechanism and weather, have been referred to as global warming. This, as we see above, is also a symptom of desertification. It has not been seen to to be so, however, because it came to our attention through the rapid buildup of carbon, methane and other gases generally associated with the petrochemical age.

To halt desertification and global weather change we have to reverse the loss of biological mass and diversity taking place. It is this mass of life which purifies and maintains the balance of atmospheric gases to sustain all life and regulate our weather (Lovelock, 1979). At the same time as we reverse desertification we have to stop adding gases at a rapid rate, particularly gases associated with modern technology and foreign to nature.

Now I want to show why we cannot reverse desertification using the current scientific management model based on our mechanical paradigm. In

particular, I want to show why the tools acceptable to mainstream science, environmentalists and ecologists, are incapable of reversing desertification on vast areas of land where the rainfall is seasonal.

IMPORTANCE OF DECAY IN SEASONAL RAINFALL ENVIRONMENTS

All life functions cyclically through birth, growth, death and decay. This applies from micro-organisms to elephants and humans. If any part of this cycle is not completed problems arise. If the uncompleted part is decay, then the whole successional process can become dysfunctional resulting in desertification.

On the earth's land surface there are two broad environments – those of perennial rainfall and those of seasonal rainfall. The areas of seasonal rainfall probably cover about two thirds of earth's land surface.

In perennial rainfall environments, such as tropical wet forests, we find a mass of vegetation growing but almost all perennial in nature. We find no large herbivore herds and their attendant pack hunting predators. We find the proportion of the vegetation that dies each year is very small, dies throughout the year and is quickly decayed by micro-organism activity. Most carbon is bound in the living and dead organic material. The key to full functioning in such environments is the low proportion of the vegetation which dies each year with deaths spread throughout the year, and the constant high micro-organism populations encouraged by moist soil and high humidity.

In seasonal rainfall environments we find a mass of vegetation grows each year during the growing season. Micro-organism populations are high while there is abundant moisture in soil and air and then drop off as soil and air dry out. Of the annual growth of vegetation, a very high percentage dies at season's end and has to decay to cycle the nutrients, retain the carbon and clear the way for the following season's growth. In fact almost everything aboveground dies except for trunks of trees and stems of these and shrubs. Most tree leaves fall and all annual forbs die as well as the aboveground parts of most perennial forbs. In addition, almost all perennial and annual grass aboveground parts die. How does this mass of vegetation complete the decay process in time to clear the way for the following season's growth? This we had never looked at seriously nor even considered a factor in desertification.

These are the environments in which we find the large herding herbivores and the pack-hunting predators and this was not by chance. In these environments it is essential that a high proportion of the annual vegetation, once dead, be consumed by herbivores and converted to dung and urine partly broken down for micro-organisms to complete the task. In these

environments this occured over millions of years until we humans changed our role as pack-hunting predators, domesticated some herbivores and decimated others and their predators.

The role of the predator was an essential one in this complex whole. The fear of predation kept many herbivore species concentrated and as no animals like to feed on their own concentrated dung and urine, they kept moving. Movement kept plants from being nibbled to death in overgrazing and overbrowsing and thus helped maintain both vegetative mass and diversity of the entire community. The trampling of concentrated animals also assisted decay and the maintenance of covered and broken soil surfaces for better moisture penetration, aeration and life. Herbivores that are not concentrated hardly trample standing dead material nor break soil surfaces as they walk and feed calmly.

In the absence of predators, both wild animals and livestock overgraze seriously and no longer perform their essential role in the annual decay process. Vegetation that does not decay merely breaks down chemically through oxidation and physically through weathering, releasing carbon to the atmosphere instead of keeping it bound in dead and living organic matter. Weather change would have occured without us ever discovering coal or oil. It would merely have taken longer to come to our attention.

As long as scientists cling to the prevailing paradigms that rest is beneficial to all land, and overgrazing is due to too many animals on land, and refuse to accept herbivores, particularly domestic stock, as tools for restoring decay, desertification and global weather changes will continue. It is impossible to address the annual need to convert masses of vegetation on roughly two thirds of the earth's land surface from chemical breakdown to biological decay with only fire, rest and technology.

HOLISTIC APPROACH

The knowledge I have just discussed concerning the critical symbiotic relationship between predators, herbivores, plants, micro-organisms, soils and weather, was discovered over twenty years ago. Because of my own scientific training and the paradigm I operated under, the evidence, although obvious, was difficult to see and even harder to clearly articulate. However, we were able to start work on these observations and produce reversals of desertification, even in drought years under greatly increased and concentrated herbivores.

These early results however were eratic and not always repeatable. Clearly something more was missing and preventing us from being able to duplicate the results anywhere in the world. Investigations showed that the break-

downs we were experiencing were not attributable to the basic concept being wrong but were always due to management – of the people and the finances. This led to us believing that a more integrated or holistic approach was required. There followed some 15 years of frustrating and eratic results until finally we were able to obtain consistent results. The problem, when finally determined lay in the fact that we had confused the integrated approach with the holistic approach, thinking that the terms were synonymous.

I finally came to realise that the integrated approach and the holistic approach were opposites. A Canadian, Maurice Berman, working independently, came to the same conclusion (Berman, 1981). Since then an Englishman (Goldsmith, 1988) came to the conclusion not that they are opposites but that the integrated approach is still disciplinary while the holistic approach is non-disciplinary. I prefer his description which I think is more accurate than my own.

Once we realised that the problem lay in the integrated approach itself, we had to struggle next with understanding not only what 'holistic' meant, but even more difficult, how to apply such an approach in day-to-day management. I have not got the space in which to discuss this struggle, but it is detailed in *Holistic Resource Management* (Savory, 1988).

Holistic management requires management in 'wholes' although wholes are never neat and self-contained but rather consist of wholes within wholes. Any management involving land requires a minimum whole that includes the people, land and money involved. These have to be managed as one indivisible unit. Next, we set comprehensive goals involving three components formulated in a specific order. First, the people determine the quality of life they seek to have and embedding their values and culture. Next they specify the forms of production required from the land that would sustain the quality of life sought – food, fibre, profit, aesthetics, recreation, cultural aspects, etc. Finally they describe and map a landscape in terms of the four fundamental processes that define our ecosystem: biological succession, mineral cycle, water cycle, and energy flow. This landscape component has to describe the land (or water) not as it is today but as it is required to be at some time in the future if the forms of production are to be sustained.

Following the formation of a whole for management and the three-part goal, we use a 'conscious' thought model that enables us to make management decisions that are ecologically, socially and economically sound. This model at its present stage of development is shown in Fig. 2.

It differs in numerous respects from the earlier 'subconscious' scientific management model beginning with the notion that before the model can be applied, a minimum whole (involving people, land and money at the least) must be defined. The *Goals* have to be formulated by collaborating people and have to include three parts: a quality of life statement, a description of

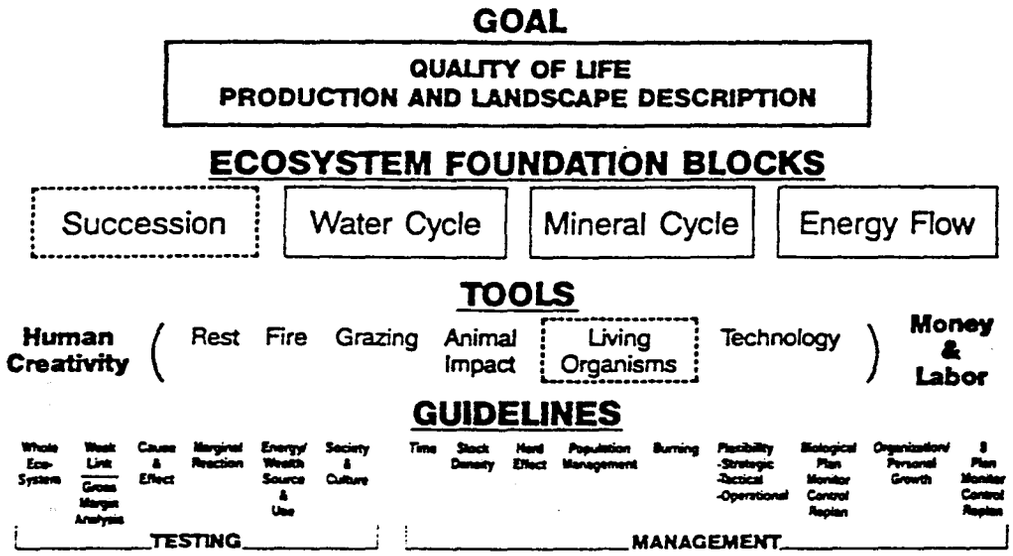

Fig. 2. Holistic resource management model.

the forms of production that will sustain the quality of life, and a description of the land as it will have to be in the future if the forms of production were sustained. This goal cannot contain prejudices against future actions, nor should it contain any reference to problems of today. The holistic goal speaks to immediate needs such as quality of life requirements and profit. However as it is one goal these are embedded in the landscape description of the future that will sustain them. The holistic goal is a vision of what people want beyond today's problems with no reference as to how to attain it. It merges culture and values with resource management.

The *Resources* are seen as the four essential processes (Ecosystem Foundation Blocks) that sustain mankind and all life: succession, mineral and water cycles, and solar energy flow. Thus the resource base is viewed as totally interconnected.

The *Tools* include the same ones available in the old scientific model, but also include living organisms, grazing and animal impact. The two tools of grazing and animal impact make it possible to reverse desertification on seasonal rainfall lands.

The *Testing* is based on questions that fall under seven headings (Testing Guidelines). These questions are designed to give final decisions which are ecologically, economically and sociologically sound and take you toward the three-part goal. All management decisions, financial planning and solving of problems are tested against the goal. In the decision-making there is a specific technique to the testing. It is similar to that used by an instrument-

rated pilot. The pilot is trained to do a quick and routine scan of several instruments. Judgments about the plane's flight are formed from a mental picture arrived at by information from all of the instruments, rather than a single one. So in holistic management are management decisions made from a mental picture of the situation from the point of view of the whole.

Finally, the process of holistic management is not complete until monitoring of all major actions is established. Because of the complexity of the real world, when the decision is made we assume it is wrong. We then determine what aspects to monitor in order to provide the earliest possible warning that we are on or off course. If all is well we proceed and if we detect the first sign of deviation from the holistic goal, we control the process. This means we use the same model in a diagnostic mode and alter the practice before once more proceeding and monitoring.

The holistic model is easier to use than the old scientific management model. The most difficult step is the goal formation, as collaboration and goals of this nature are so alien to our society. Even the testing process can be quickly taught. However, we find no progress can be made until the people involved are able to make the necessary paradigm shift. It is essential to break out of the mechanical 'systems approach' to understand the holistic management 'process'. Only knowledge blocks learning. We are so accustomed to managing resources through our systems approach that after a lifetime of this it is hard indeed to grasp the simplicity of replacing them with process. We manage with agricultural systems, range mangement systems, educational systems, economic systems, to name but a few.

Despite some 5 billion people on earth, each of us has a unique fingerprint. So too, despite all our people and land units, is every one unique. There is more chance of someone having my fingerprint than of duplicating my family, farm and economic resources. However, while my fingerprint remains the same every day of my life the same is not the case with my whole farm. In this case it is unique every year. People are growing and maturing, dying, divorcing and changing their values and perceptions. New people are being born into the family. The seasons all differ and the markets change constantly.

When we appreciate the constantly changing uniqueness of all wholes, we see the arrogance of present science. It was arrogant to believe, as we did that we could predetermine management systems. Arrogant to predetermine 'best management practices' and so on. Now in hindsight it is clear that what we should have done all along was settled for clear goals and a decision and monitoring process.

To date we are finding this process of holistic management is universal in its application in terrestrial situations. It functions across all boundaries, ecological and societal. We are also finding consistency now in results. In

some of our more advanced training courses we routinely try to find ways to make holistic management fail and thus far have been unable to do so.

In practice we now have some impressive results: ranches doubling production, while halving the costs of production, and experiencing substantial improvement of the land even in drought years; short periods of analysis showing where millions of dollars could have been saved in government budgets where resource management policies had no chance of success; managers routinely discovering serious faulty economic decisions which were undetectable with the conventional model.

We have no experience yet of applying this model in aquatic environments and are just starting to do so. The basic idea is likely to hold but there will be a need for considerable development in practice.

When we set out to put a man on the moon we did not anticipate the many other benefits such as smaller computers and other devices in our lives. In a similar manner, when we set out to solve the problem of desertification we did not know where it would lead. It led, as indicated, to learning how to manage holistically with this conscious model. What had not been anticipated were three other powerful uses of the same model. We have now learned that it can be used to diagnose resource management problems before costly and faulty measures are undertaken. We have learned that we can analyse the policies of governments and international agencies among others and determine ahead of time if they are likely to succeed. If they are not we can use the same model to design policies that if applied would be likely to succeed. Finally we have learned that we can use it to support research and assist us to determine areas of urgent research need in resource management situations.

Using a combination of the diagnosis and policy analysis modes we can relook at environmental impact statements and evaluate them. Doing this we routinely find that costly and exhaustive environmental impact statements are letting faulty policies pass. This is not surprising as all such policies are formulated and then evaluated on the same underlying subconscious model described earlier.

We have long seen the need to relook at economic modelling using some of what we have learned, but all of us involved in the development of holistic management have lacked the necessary skills. However, we have started to work on this at the level we were familiar with: financial planning and decision making on farms, ranches, forests and wildlife areas. We were inadvertently pushed into this when we found that the most sophisticated financial planning available today in agriculture was not adequate to truly serve the needs of agriculture. By using the HRM model in annual financial planning we have found new ways that are simple and which are radically changing the profitability of situations despite working with the same

people, products and markets. These, at their present level of development are more fully explained in *Holistic Resource Management* (Savory, 1988) and its companion workbook (Bingham and Savory, 1990).

CONCLUSION

I feel strongly that new economic modelling will have to work on the principle of wholes within wholes. I believe it will have to have the same underlying ecological foundation as holistic management. However, having found a solution to the desertification aspect of the problem and a possible base of new economic modelling, we're still left with enormous problems and details to work out. We at the Center for Holistic Resource Management lack the skills, staff and funds to be able to undertake this and we hope that we can interest some of you in taking our work and developing it further along these essential lines.

REFERENCES

Berman, M., 1981. Reenchantment of the World. Cornell University Press, Ithaca, NY, 353 pp.

Bingham, S. and Savory, A., 1990. Holistic Resource Management Workbook. Island Press, Covelo/Washington, DC, 181 pp.

Goldsmith, E., 1988. Gaia: some implications for theoretical ecology. Ecologist, 18 (2/3): 65–74.

Lovelock, J., 1979. Gaia: A New Look at Life on Earth. Oxford University Press, Oxford, 384 pp.

Savory, A., 1988. Holistic Resource Management. Island Press, Covelo/Washington, DC, 564 pp.