The Institute of Ecotechnics

An Institute Devoted to Developing the Discipline of Relating Technosphere to Biosphere

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"Whatever you can do, or dream you can, begin it: boldness has genius, power, and magic in it."

Goethe

"See the end in the mirror of the beginning and the beginning in the mirror of the end."

Ancient Proverb

INTRODUCTION

The Institute of Ecotechnics operates its projects in seven countries and on a ship that voyages the tropic oceans, the Mediterranean, and the Amazon. Fourteen associates initially founded the Institute with a capital of US$ 25 000 to make the down payment and start up operations on a badly eroded ranch in New Mexico in 1969, with the purpose of beginning and developing a new discipline; interrelating ecosystems, including man, his cultures, and his technosphere with the evolving biospheric totality on the planet earth. In addition they forwent all pay for the first year, an equivalent of over US$ 200 000.

The initial associates included an MBA entrepreneur engineer, an artist, a dancer, the former Head of the Computer Users Consultancy Department of Lawrence Radiation Laboratory, a philosopher, a chemist, a communications technician, a union organizer, and an AIA architect—student of Frank Lloyd Wright and Bruce Goff, and five young 'all-rounders', all ready to commence the endeavor of creating the beginning of the new discipline seen as critical for themselves personally, their society, and for Nature.

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Fig. 2. The Institute of Ecotechnics office and library located in I.E./SARBID Ltd. renovated Victorian building at 24 Old Gloucester St., London, near the British Museum.

By 1973, the Institute was incorporated in the State of New Mexico and by 1981 was registered as a Research Institute in the United Kingdom and about fifty associates are active members. Its projects, now averaging about US$ 500 000 each in start-up costs, exist in the USA, UK, France, Nepal, India, Australia, Puerto Rico, and in the tropic waters, concentrating on areas of ecological mismanagement: rainforests, savannahs, deserts, city centers, rivers, and coral reefs.

Present day institutions generally recognize the existence of Law, Medicine, Engineering, and Management as disciplines: Law dealing with the relations of men, women, and children with each other; Engineering, of man and the economic application of science; Medicine, of persons with their bodies; and Management, of people with productivity and distribution. The founders of the Institute saw the need for a discipline relating humans, their cultures, and their technics to the biosphere.

Of course, sciences such as ecology, ethology, culturology, linguistics, biochemistry, ethnobotany, geology, soil science, etc., contribute much in the way of knowledge to the venture; but, just as lawyers require cases, engineers problems, doctors diseases, and managers enterprises to practice upon, ecotechnicians require fairly large-scale projects facing ecological-type crises to develop their understanding: putting in a savannah system in a desertifying tropical bush area; a restored and species-enriched jungle in a cut-over area badly eroded from cash cropping. The core of the discipline: to make a viable project that upgrades the richness, harmony, and stability of a specific ecosystem for soils, for plants, for animals, for men, for cultures.

Owned by its active members, the Institute self-generates its finances from ongoing cash flows after the initial start-up. Projects are closely budgeted and cost controlled to ensure that the economic factor, although not regarded as the goal of the process, gives a fundamental check as to whether the project proceeds without social waste, thereby becoming a burden on society.

Ecotechnics provides research into the ecological use of technics and the technics of ecology by extending the subject matter of ecology past its usual limits of studying floral and faunal population, their environmental resources (mineral and gas cycles), and their interplay, to include human, mechanical, chemical, cultural, and decision-making populations into the 'equation'.

Fig. 3. Les Marronniers, I.E. conference center, located 5 km north of Aix-En-Provence, France. Les Marronniers was architected in an integrated ecological system incorporating the elements of farming, grazing, woodlands, orchards, artisan atelier and residence. The Louis Quatorze maison and attendant buildings house up to thirty persons and maintain versatile facilities for workshop, conferences, dance or theater. Pelcourt 13100, Aix-En-Provence, France. Telex: 410943 MARECO F.

CONCEPTUAL MODEL

The conceptual model used by the Institute of Ecotechnics results from research in ecological management conducted by I.E. and associated ventures.

The first step to evaluate and initiate action on projects is the identification and delimiting of the 'eco-region', the fundamental unit of diversity (*that stubborn stability of context that forms an identity for the area despite some variations in culture, soils, geology, etc.*). The evaluation then proceeds to examine the levels of complexity or 'existential strata' operating within this eco-region. These may be arranged hierarchically into twelve categories, four inorganic, four organic and four superorganic.

In the inorganic we begin with the level of *heat*, or the amount of non-directed energy available in the system for further transformation. Climate, seasonal and diurnal variations are assessed here.

Next *field* orientation, the eco-region considered in relation to geography of the planet, gravitational fields, to the electromagnetic spectrum. At this level are determined rainfall, water movements, wind and tidal forces.

The third level of *atoms* includes a study of the quantity and distributions of atoms and simple molecules from sub-surface to atmosphere. Two especially key subsets would be the life elements including the presence of trace elements, and toxic elements in the eco-region, their history of increase or diminution.

The last inorganic level is *structure*, or mineral. Here the geology of the area and the set of buildings, roads, infrastructure, are mapped and inventoried.

At the level of *soil*, life enters: study of the microflora, microfauna, soil profiles and structure and history of soils in the area.

At the level of *species*, or *organisms*, which genera and species flourish in the region, which do not. One can look at the possible eco-niches: are they presently filled, could the diversity of life be increased by suitable introductions? What eco-niches might be created? What is the present and potential biomass and species diversity of the region?

Then *groups*: stands of plants, herds of animals, groupings of humans—house, village, city.

The eighth level is *eco-communities*—the relationships between soil, species and groups. Demographic studies at this level would include the economic basis of human interactions, as the type of eco-community varies for pastoralist, farmer, miner, information worker, tourism. What technologies are being employed, what competition and cooperation exist between various eco-communities within the region? Which are increasing?

Above this level symbol, culture patterns, and historic decisions and commitments play the dominant role—but these levels, often omitted or taken implicitly in scientific studies, have a pervasive and effective 'tinture' effect as they permeate attitudes, motivations, values and patterns of human interaction within the eco-region. Human cultures can be regarded as the dynamic structure of man's adaptations to his environment and they flourish or decline under the challenge of opportunity and the necessities of survival.

These 'super-organic' levels are: *culture-creators* (outstanding individuals in the region who are role-models or contribute to the development of culture), *schools* (of art, science, artisanry etc.), *cultures* (ideas and values carried out over time present in the region) and *ecumene* (the level of planetary decisions as they affect individual eco-regions, and to what extent the region participates in making these decisions, for example, a free port area).

From the individual study of these strata we proceed to their interplay with particular attention to the bottlenecks or limiting factors in the region, determination of the equilibrium and the degree of its stability. Then the energetic exchanges between strata, with particular attention to groups of three, with a given level characteristically being sustained by the level beneath it, and being sustaining to the next higher one.

With an overview now of the organized complexity within the eco-region, we can pay attention to the inefficiencies or entropy present. The term entropy employed in this text is not that strictly defined by thermodynamics or statistical mechanics rather that definition accepted in communications theory. Entropy can be divided into four aspects:

(a) material entropy, i.e., soil erosion, pollution, depletion of natural and cultural resources.

(b) energetic entropy, degradation to lower, less organized forms.

(c) information entropy, resulting from a lack, glut, or wrongly directed data.

(d) conceptual entropy, from scarcity of concepts, invalid or inappropriate ones resulting in management by crisis or habit.

Anti-entropic forces include:

(a) material transport—to balance material entropy, or existing lacks in the region.

(b) energy transport—photosynthesis, electrical generation etc.

(c) communication—with the key element of discrimination, getting the right information to the right place and person at the right time.

(d) synergetic systems—to produce systems where the whole is greater than the sum of the parts and unpredictable from them.

Fig. 4. Homestead at Savannah Systems: utilizing local materials and designed for comfortable living in the tropical savannahs.

Now a balance sheet for the eco-region can be made from the amount and types of entropic and anti-entropic forces in imports or exports to other regions, and within areas of the same eco-region (the effects of individual projects on the region).

If a fundamental aim of all managers is to increase the potential and efficiency of a system to do work, increase its free energy, and to decrease the entropy it produces, it follows that an ecological manager would strive to do this without subtracting a like or greater amount from other parts of the eco-region or other regions.

Finally an evaluation of proposed or on-going actions and processes would study effects on the existential strata, their interactions and equilibrium, and the entropy balance. What type of feedback cycles are operating—positive or negative? This conceptual model is in fact designed to operate as a feedback mechanism to managers, scientists, policy-makers. The cycle can now be repeated for a further 'progressive approximation' or more detailed studies of limiting factors or critical areas revealed in the initial survey, or with particular relevance to proposed courses of action.

Fig. 5. Homestead buildings.

PROGRAMME

Ecotechnic theory and practice is transmitted and refined by (1) the operation of programmes for apprentices; (2) the working out of joint ventures with scientists, entrepreneurs, explorers, artists; (3) holding working intensive conferences of leading scientists and managers on a comprehensive approach to areas such as Oceans or Behavioral Conditioning Systems.

Apprentice programmes usually run nine months, but can range from three days depending upon the individual's specific aim. For the longer

Fig. 6. At Savannah Systems, cattle graze improved pasture, previ ously second-growth wattle on overgrazed invertisol.

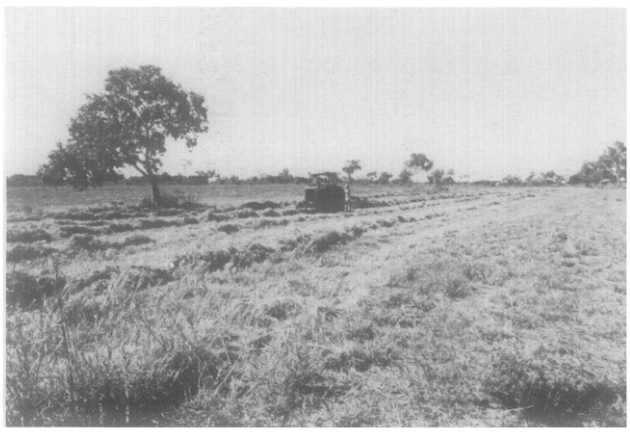

Fig. 7. Haying nitrogen-fixing *Stylosanthes* after the seed has been collected at Savannah Systems.

programmes, not only technical skills, but skills in presentation of ideas, self, and project are developed. So techniques from speech, psychodrama, distinguishing between negative and positive feedback loops in action, the interaction of theory X, theory Y, and theory Z managements, group dynamics, and non-linear and paradox thinking are required. The practitioner learns to think in large-scale comprehensiveness, to feel in gestalts or wholes, and to act with incisiveness, and hopefully, the necessity for contemplation of the total situation.

Since the apprentice method is used, that is, the practitioner is plunged into the real-time, real-cost situation, making some contributions to cover his/her mistakes and instruction time, the costs of the programme can be held to US$ 100–200 a month which cover the basic room, board, equipment costs. Degree programmes have been worked out for a few highly qualified individuals. About twenty apprentices are engaged at present.

Joint ventures have included sharing the use of the R/V Heraclitus with Botanists on the Amazon and with the University of Singapore in Southeast Asia; the cooperation of the Puerto Rico Rain Forest project with the Department of Forestry, etc. These are worked out on a mutual benefit basis.

The Conferences have been held since 1974, primarily at the Institute's project on an old farm near Aix-En-Provence where the Grand Maison has been renovated to provide facilities, but also in Kathmandu, Perth, Fort Worth, Surabaya, Penang, Bombay, and London. The conferences are characterized by a genial and creative atmosphere, non-media and non-governmental, in which not only the facts, but the basic concepts and contradictions of on-going work at the frontiers of science, management, exploration, and art can be explored.

Only one of these proceedings has been published, that of the 1980 Planet Earth Conference. Given the title of that conference, *Man, Earth, and the Challenges*, published by Synergetic Press*, London, it includes speeches given by Dr Thor Heyerdahl, Dr Alexander King (Club of Rome), William Burroughs, Dr Ghillean Prance, Dr Bernhardt Lotsch, Dr Edwin McKee, Dr Gregory Khozin of the Soviet Academy, and others. The first conference series which considered in turn Oceans, Deserts, Mountains, Jungles, Planet Earth, Solar System, Galaxy, and the Cosmos, will metamorphose in December 1984 to a series on 'The Biosphere'.

BRIEF DESCRIPTION OF SOME OF THE PROJECTS

The Tropical Savannahs—Savannah Systems Pty. by Mark Nelson

In conjunction with Savannah Systems Pty., the Institute operates a working demonstration project for semi-arid tropical savannahs near Derby, in the remote Kimberley region of Western Australia. The 5000 acre property, Birdwood Downs, is a series of sand ridges of predominately

*£3.50 plus postage. Address for orders: Synergetic Press, 24 Old Gloucester St., London WC1, UK.

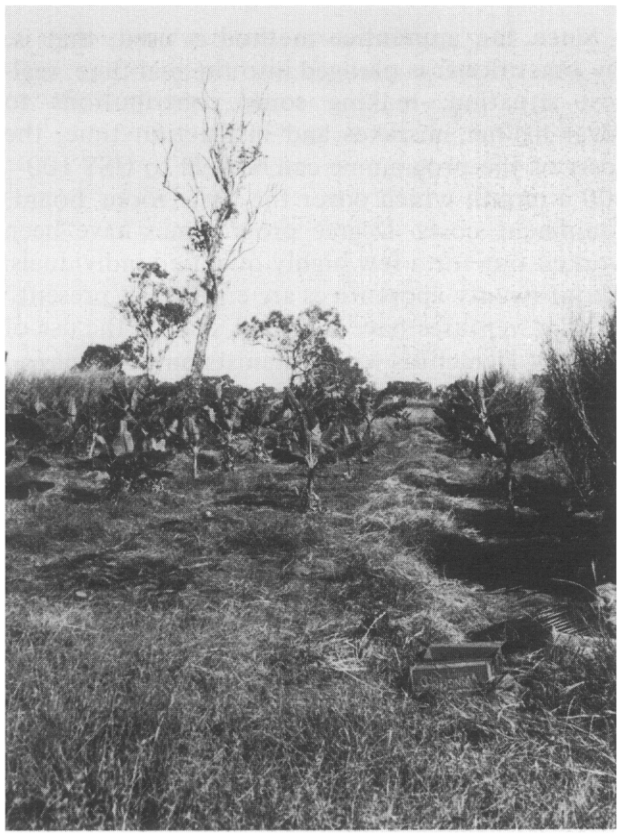

Fig. 8. Experimental orchard with drip irrigation and windbreak planting.

sandy loam, old tropical soil which has been overrun by poorer grasses and acacia scrub trees ('wattle'). Since 1974 trial fields of improved grass and legumes and promising fruit, shade and fodder trees have been grown for seed production and for evaluation in erosion control, grazing, haying, fertilizer and other management alternatives.

The Kimberley's severe environmental challenges make the projects' results relevant to the dry tropics worldwide. Highly variable annual rainfall, including monsoonal flood and drought (annual rainfall can vary from 5″ to 40″), high winds, danger of fire during the eight to nine month 'dry' season, long distance from urban centers and markets, and a history of poor pastoral practices have resulted in widespread desertification, land degradation and marginal economics.

The Institute works with the *Stylosanthes* legume family from South America and the Caribbean, especially Verano and Fitzroy stylo, as they are extremely drought resistant and do well in poor soil. The mixed pasture produces a denser plant stand minimizing erosion, fertilizer requirements are lowered and grasses thrive from the nitrogen-fixing of the legumes.

Fig. 9. Haybarn, equipment line-up overlook Verano paddock.

The total system approach taken by the Institute includes the complete vectoring of a community in the tropic savannahs: architecture adapted to the local climatic conditions, materials, cultures and needs; wind and solar systems; appropriate mix of animal, mechanical and electronic technics, and cost benefit analysis.

The initial clearing and replanting of 2500 acres of degraded 'bush' country will be completed by August 1985. Experimentation in clearing techniques utilizes machine and hand methods followed by cropping programmes. The old sand ridges are left covered with eucalyptus, bloodwood and other non-acacia trees; the larger trees and natural groves are also preserved in the valley pastures.

Leuceana leucacephela shows great promise as windbreaks, fodder, and shade trees. In an experimental orchard, banana, papaya, mango, cashew, citrus and other fruits are tested. About 800 acres at present are in pasture and crop production with trial evaluations of various legumes and grains such as sorghum, lab-lab, soybean, cowpea, and maize. In addition, other grasses and legumes are being evaluated for use in various soil, fertilizer and stocking regimes.

Seed produced at Birdwood Downs has gone to places ranging from Alice Springs in the Australian desert, to Saudi Arabia, West Africa and the dry sub-tropics of Texas to aid in desertification control and demonstrate the potential of the dry tropics to be sustaining food producers.

Cattle and Horse Breeding—Quanbun Downs by Diana Mathewson

The Institute of Ecotechnics jointly operates with Outback Cattle and Horse Breeding, Quanbun Downs, a 300 000 acre ranch in the Kimberleys of Western Australia, to test the Savannah Systems results on a working ranch.

Quanbun Downs comprises many land systems which include different soil types and vegetative covers. Native mammals, reptiles, birds, and fish occupy the station's land, rivers and billabongs. The Kimberley area is a study in extremes with the 'wet' and 'dry' seasons demanding new approaches and attention to problems of natural as well as man-made catastrophies.

The cattle at Quanbun Downs graze in paddocks of up to twenty thousand acres and are gathered on horseback yearly. A series of big round-ups are scheduled after the wet season to gather the commercial herd. These cattle are driven to working yards where they are tagged and recorded, branded, and pregnancy tested. Outback Cattle and Horse Breeding is involved in a research demonstration of tagging and recording the total commercial herd. A breeder cattle herd raises fresh stock and new bulls for introduction to commercial herd. About 600 head were shipped last year.

Fig. 10. Seed processing shed: modern technology permits highly efficient 'micro-factories' located where people work.

Research and work on regeneration of degraded pastures, erosion control, and increased pasture production is another line of the Institute's total systems approach. Desertification of lands through mis-management of grazing animal population is a well-recognized problem in the Kimberleys. Savannah Systems, working as a pilot plant, advises Quanbun Downs on its regeneration programme for prototype production testing. Action now being undertaken to regenerate the land includes: plowing and seeding, exclusion during the wet, slashing and cutting pasture-intruding trees, introducing new grass species, and allowing the native grasses to re-establish.

The Tropical Rain Forest—Las Casas de la Selva by John Druitt

Las Casas de la Selva, established in early 1983, manages a 900 acre parcel, put together from abandoned holdings, after severe erosion had destroyed its farm possibilities, within the tropical rainforest in the south-eastern part of Puerto Rico. The forest lies backed against the Cayey National Forest in the Sierra de Cayey mountain range, characterized by narrow ridges between

Fig. 11. Quanbun Downs main homestead.

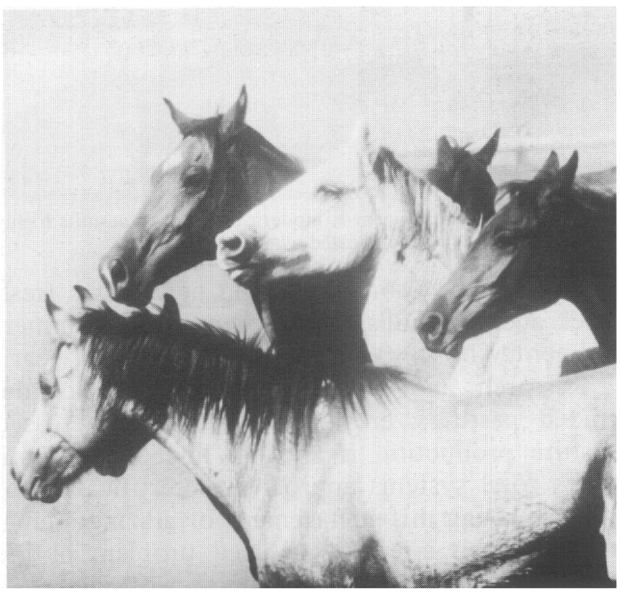

Fig. 12. Quanbun Downs horses.

slopes of 30% to 60% at an elevation of between 750 to 1850 feet. Annual rainfall is within the range of 80–100 inches with year-round high humidity.

The aim of the management at Las Casas is to establish a demonstration model of a synergy of faunal, fungal and floral populations within the tropical rainforest system context which will produce economic benefits.

The first practical step now in progress is the collection and evaluation of adequate baseline data. As the data develop, and at timely decision points, tracks with appropriate drainage, fencing and working areas in preparation for the planting of indigenous and exotic timber species are being made.

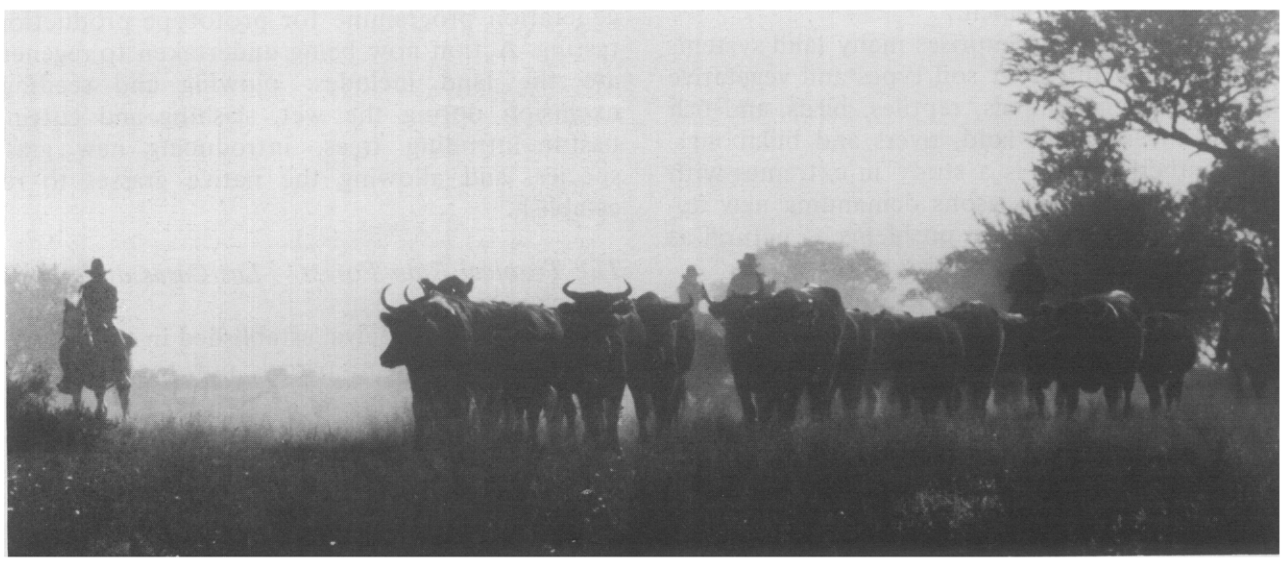

Fig. 13. Cattle round-up

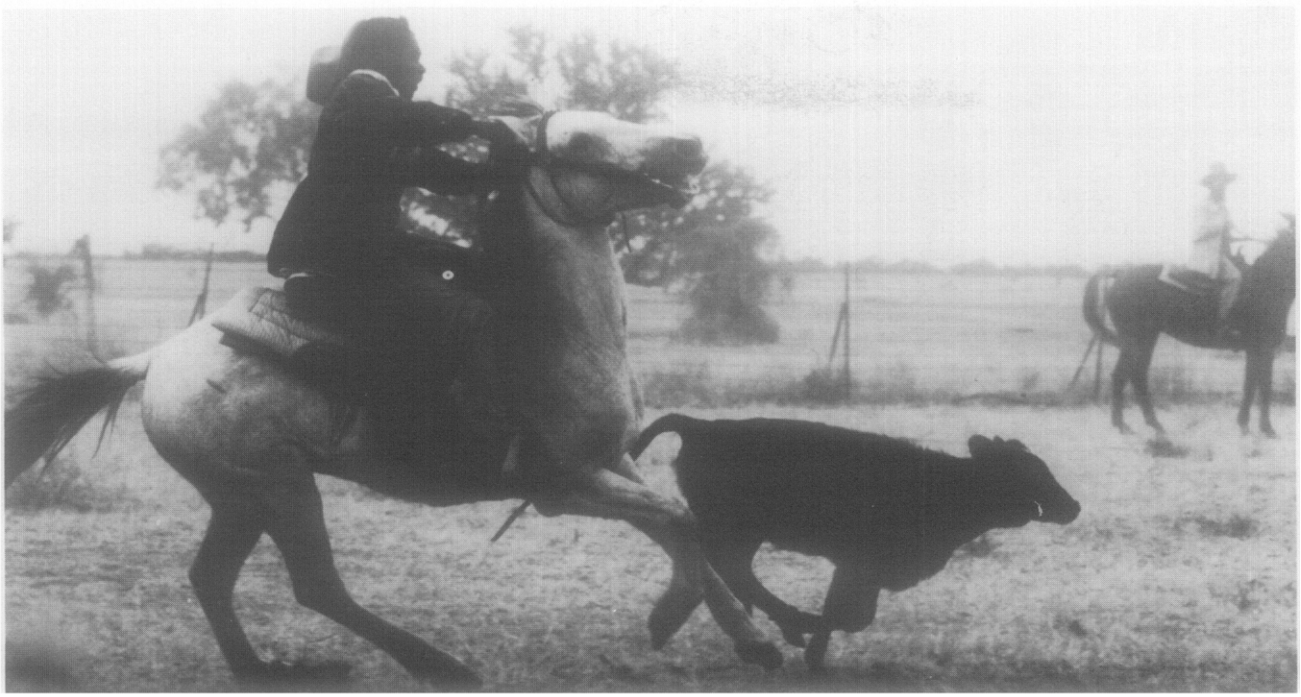

Fig. 14. Stockman on the cattle round-up.

In May 1984, a programme of progressive line planting, worked out with cooperation of the Department of Forestry, will commence. Parallel lines through the forest will be cleared leaving all existing useful woods and planting species such as mahoe *Hisbiscus elatus, Pinus caribaea,* and teak *Tectoria grandis*, thereby enriching the existing secondary forest. The seedlings will grow up rapidly under the shade of the neighboring trees and after five years will be thinned out and the remaining previously uncleared areas prepared for the planting of more saplings. The cleared and thinned trees will be treated for termite attack and dry rot, and sold as fence posts. After thinning, the remaining trees will be allowed to mature, a period of between fifteen and twenty years, before being felled and sawn up into timber for resale. The practices will utilize approximately 300 acres of available land.

Some areas of the forest had previously been planted in coffee, utilizing fruit and legume trees as shade, until it became uneconomical about fifteen years ago. Some of these areas will be upgraded to establish an area of producing fruit trees of many well-known species and varieties, which will be managed on an economic basis, as well as an area of experimentation with commercially undeveloped species which may prove to be of economic value throughout the tropic world.

Other areas will be utilized for experimental and commercial production of plants with medicinal potential from all parts of the tropic world. Selected species will be chosen by management based on recommendation and collections made throughout the tropics by cooperating institutes and ventures, such as the 'Around the Tropic World Expedition' with the R/V Heraclitus.

Remaining areas, about 400 acres, will be left undisturbed, available for studies within a secondary forest context; these will be focused on energy flow, edaphic, micro and macro organisms, mineralogy, associational succession and community dynamics. Total production records of inputs and outputs are to be maintained so that the systems negative feedback loops are maintained as data for management decisions.

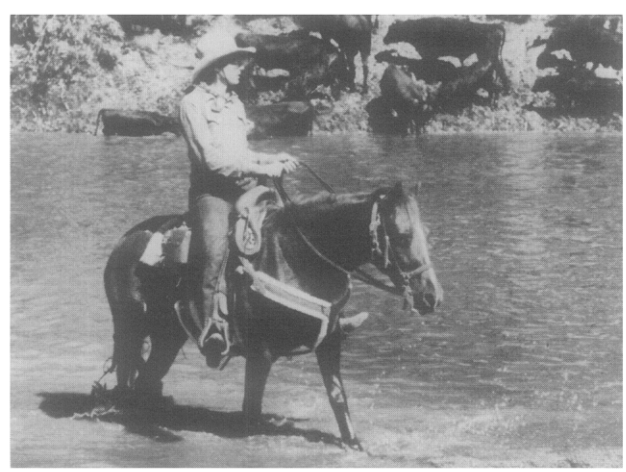

Fig. 15. Quanbun Downer crossing the Cunningham river.

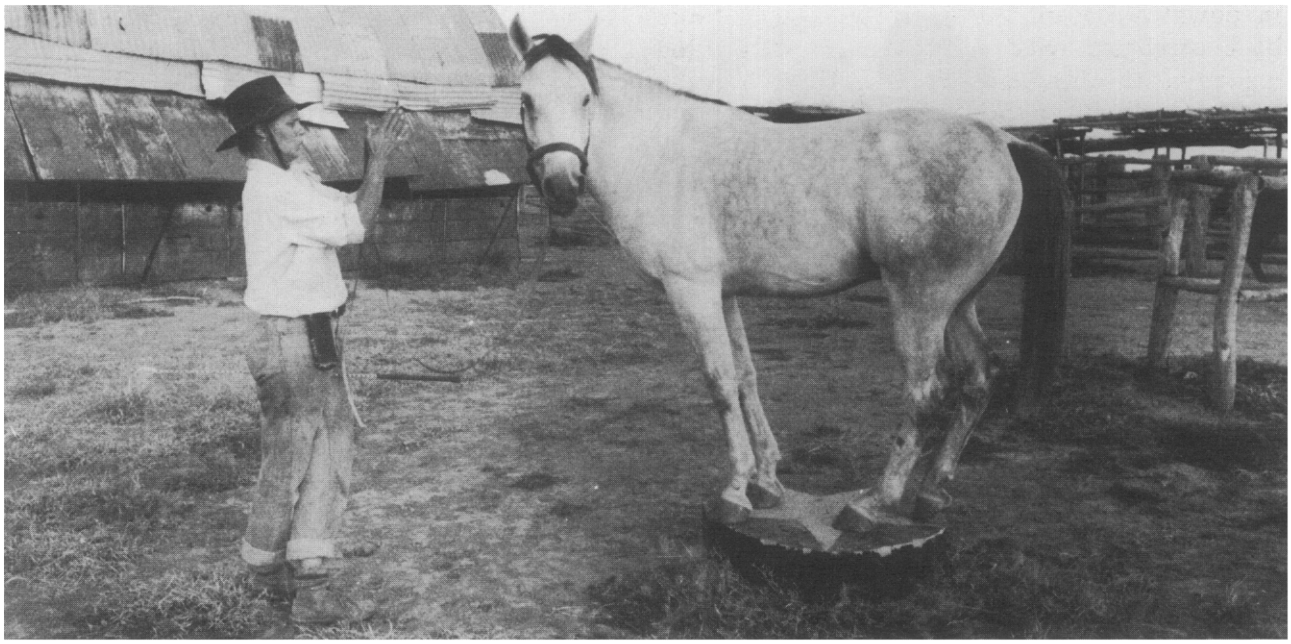

Fig. 16. Station manager, Diana Mathewson, with Polish Arab stallion being bred to Kimberly range horses.

Tropic Seas Expeditions—R/V Heraclitus by Robert Hahn

The Institute of Ecotechnics, with the cooperation of Tropic Ventures and Space Biospheres, Inc., announces a joint-venture training programme designed to equip a number of people with a complex of skills useful in planetary exploration. The programme includes learning by classes and by doing the operation of an 82' sailing auxiliary-engined deep sea vessel, ropes, sails, pumps, plumbing, electric, piloting, celestial navigation, wood and metal working, small boat and royak handling in surf and reef, diving and reef exploration, but above all in dealing with a total system in an uncertain environment instead of being trained as a specialist in a relatively controlled compartment.

The voyage commences from Asau in Western Samoa in April, 1984, and proceeds to the Solomons, Louisades, Niu Gini, Northern Australia, Banda Sea, Indonesian Islands, Singapore, Malaysia, Sri Lanka, Cochin, Djibouti, Jeddah, Suez, Izmir, Samos, Sardinia, Marseilles, Balearics, Sevilla, Senegal, and is scheduled to finish in December 1985 in Puerto Rico. The R/V Heraclitus has completed 80 000 miles of ocean voyages to date plus a 5000 mile voyage up and down the Amazon.

The Institute of Ecotechnics—India

The Institute of Ecotechnics, India was founded after the noted analytic-environmental chemist, Dr Balkrishna Tejam, was invited to speak at the Institute's first annual international conference on Oceans in 1976, to report on his work on the increasing trace metal element pollution in the Bay of Bengal. Highly interested by the ecotechnic approach, Dr Tejam and a group of Indian scientists established the Institute of Ecotechnics, Bombay, India, the following year.

Working on the development of the new discipline of ecotechnics, I.E. India has undertaken two significant scientific projects:

(1) A survey of the water-quality of the river systems in the state of Maharasthra in cooperation with the University of Bombay. A pioneer study of overall chemical interactions and their effect on environmental, human and industrial processes by measuring important parameters at key locations along an entire water system.

(2) I.E. India is studying the efficacy of various traditional materials for waterproofing and treating Typha reeds—the proto-historic boat building material of the Indian sub-continent. As a continuing aspect of the investigation of the early sea-history of man, and with help from Dr Thor Heyerdahl, extensive survey and documentation of traditional boat building was conducted, visiting well over one hundred ports on the Indian coast, Sri Lanka and the Andaman Islands over the past three years.

The Caravan of Dreams Desert Dome and Rooftop Gardens by Margaret Augustine

The rooftop gardens climaxed by the 50' diameter geodesic Desert Dome are an important element in the total design concept of the Caravan of Dreams, a performing arts center located

in downtown Fort Worth, Texas. The Institute of Ecotechnics acted as ecological systems and management consultant to SARBID Ltd., the architectural firm responsible for the concept and design architecture and quality control of the project.

People have always been drawn to the starkness of the desert landscape for contemplation and vision, gaining strength in reflecting on its story of survival against adversity. In counterpoise to the creative ferment of the arts and the swirl of social interaction in the city, the desert speaks of individual challenge and response, the power of the elementals. Perhaps desert life is the 'avant-garde' of nature, the pioneer plant, able to adapt to testing conditions, establishing itself in favorable ecological niches, taking full advantage of each chance rain.

The rooftop gardens greenhouse and geodesic dome celebrate the unusual and tenacious life forms of the planet's deserts. The outside planters feature the flora of the northern Chihuahuan Desert, west Texas and adjacent Mexico.

The dome contains over 300 succulent species from four desert regions of the Old and New Worlds: Malagasy, Namibia, Sonora and Tehuacan. They are so arranged as to demonstrate the steps of their adaptive evolution to extreme heat combined with a reduced, erratic water supply. The Caravan of Dreams contains the largest collection of succulents open to the public in Texas. The working greenhouse next to the Desert Dome cultures seeds and cuttings from the many rare and endangered species in the dome.

A fifteen-foot mountain and multi-level simulated rock landscape with caves and ledges allows one to experience the space vertically as well as horizontally within the dome. The natural quality of the rock formations throughout the rooftop was achieved by using castings from actual limestone rock outcroppings in Arizona. Two waterfalls, one emerging from a rock outcrop and the other emerging from the dome mountain, cascading down an arroyo and falling from the upper roof to the lower roof, provide the white noise background for the outdoor roof garden.

The dome's plants illustrate how widely differing genetic heritages have evolved into succulence. In some cases their forms are virtual 'look-alikes', examples of what biologists call 'convergent evolution'. Eight plant families from four different arid bioregions of the planet grow within the dome.

In addition to convergence of life forms, shapes and colors, the Desert Dome shows how a few plant families actually accomplished the evolutionary change from leafy, thin-stemmed, dark green 'normal' plants into succulent forms. Visitors can see evolution in action. Adaptations to sand dunes and rock crevices are among the many transformations displayed.

Fig. 17. Tropical rainforest vista at the Institute location in the mountains of Puerto Rico.

In short, Nature is the great sculptor of plant flesh. Succulents have deservedly become totemic symbols of life's resilience.

The dome also serves as refuge for a few succulents endangered by the expansion of cropland, overgrazing and overcollection. For instance, *Aloe suzannae* of Malagasy may have fewer than one hundred individuals still growing in the wild. The Desert Dome at the Caravan of Dreams will propagate these threatened succulents. One day, they may be needed to replant the devastated wilderness.

CONCLUSION

The Institute represents at present the results of fifteen years effort and contemplation to

Fig. 18. Cutting a path through the underbrush.

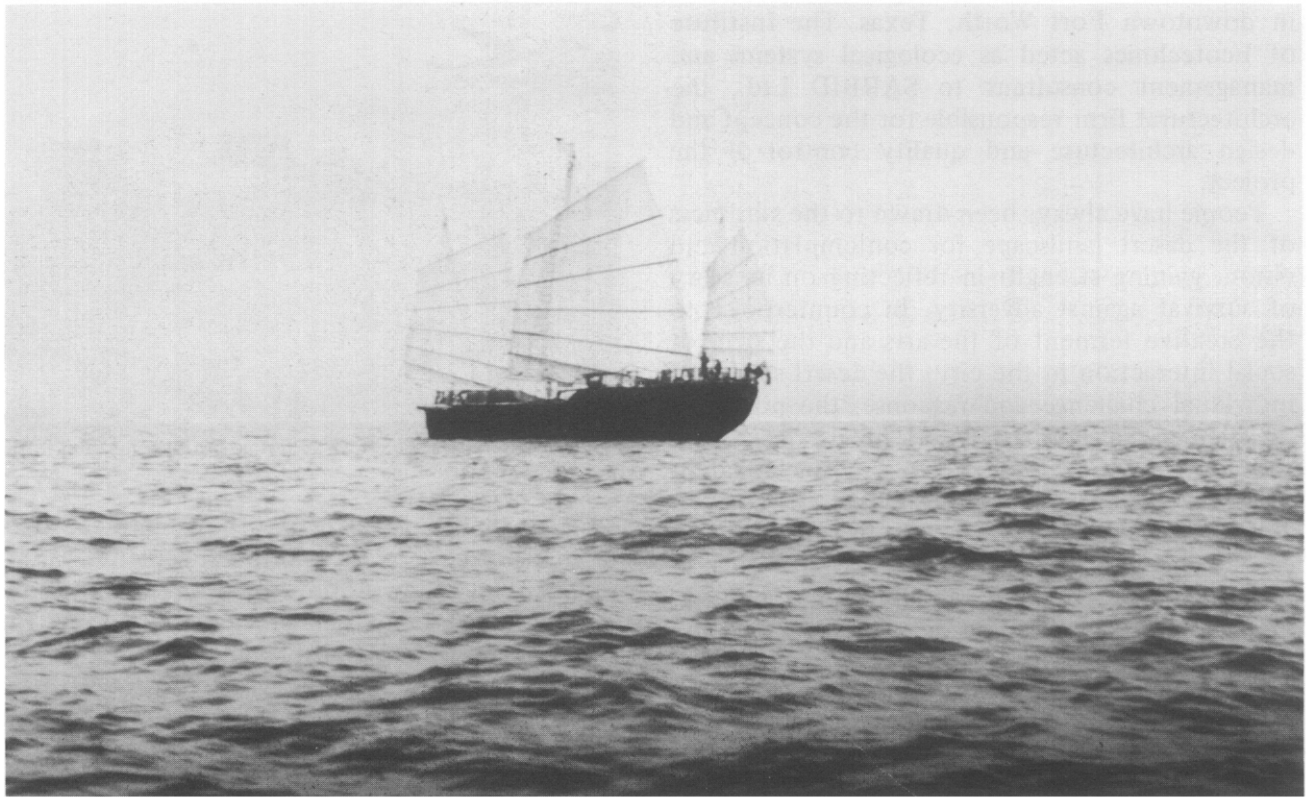

Fig. 19. Synergy of ocean-going junk design and ferro-cement hull and deck.

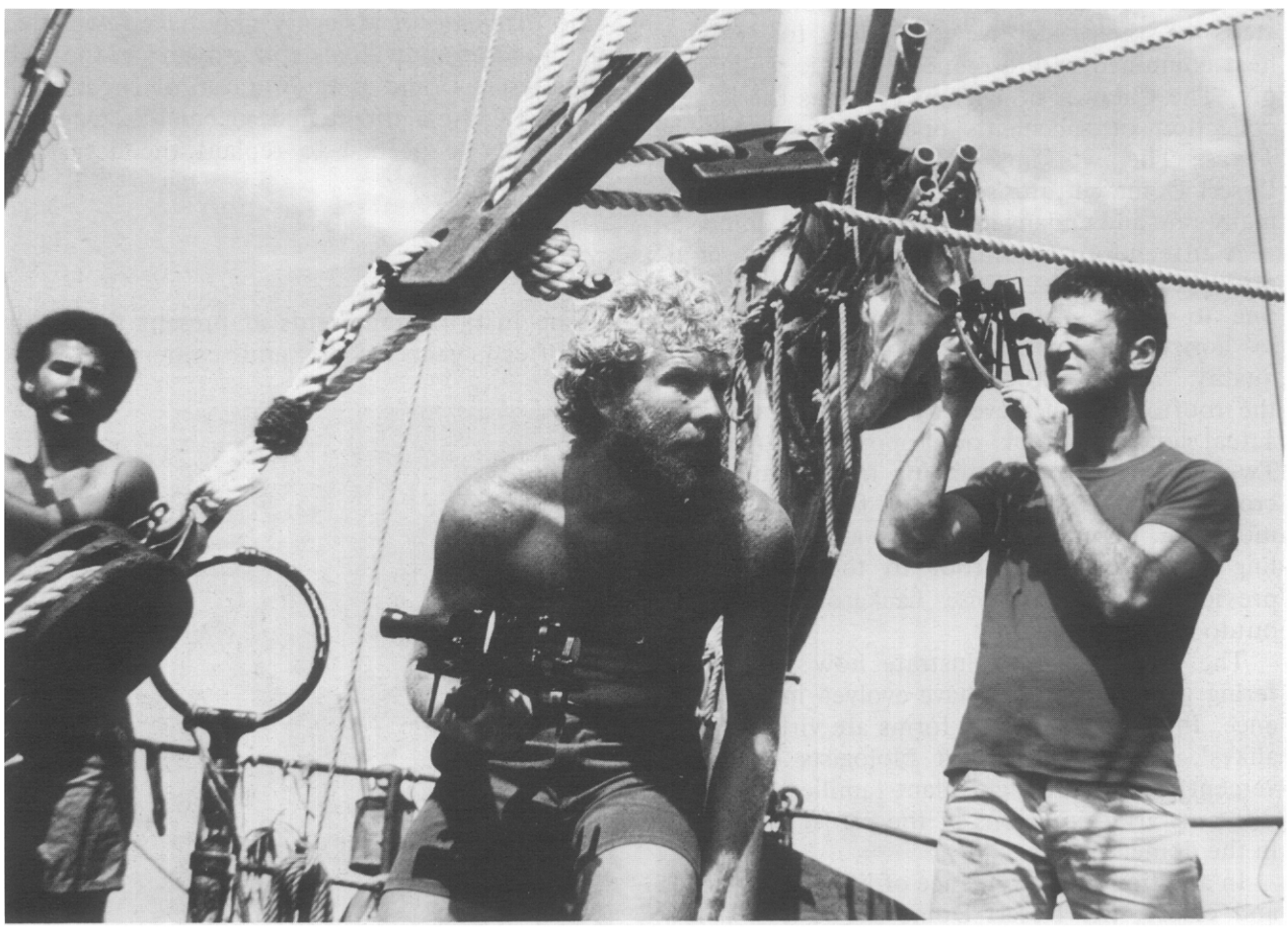

Fig. 20. Celestial navigation practice.

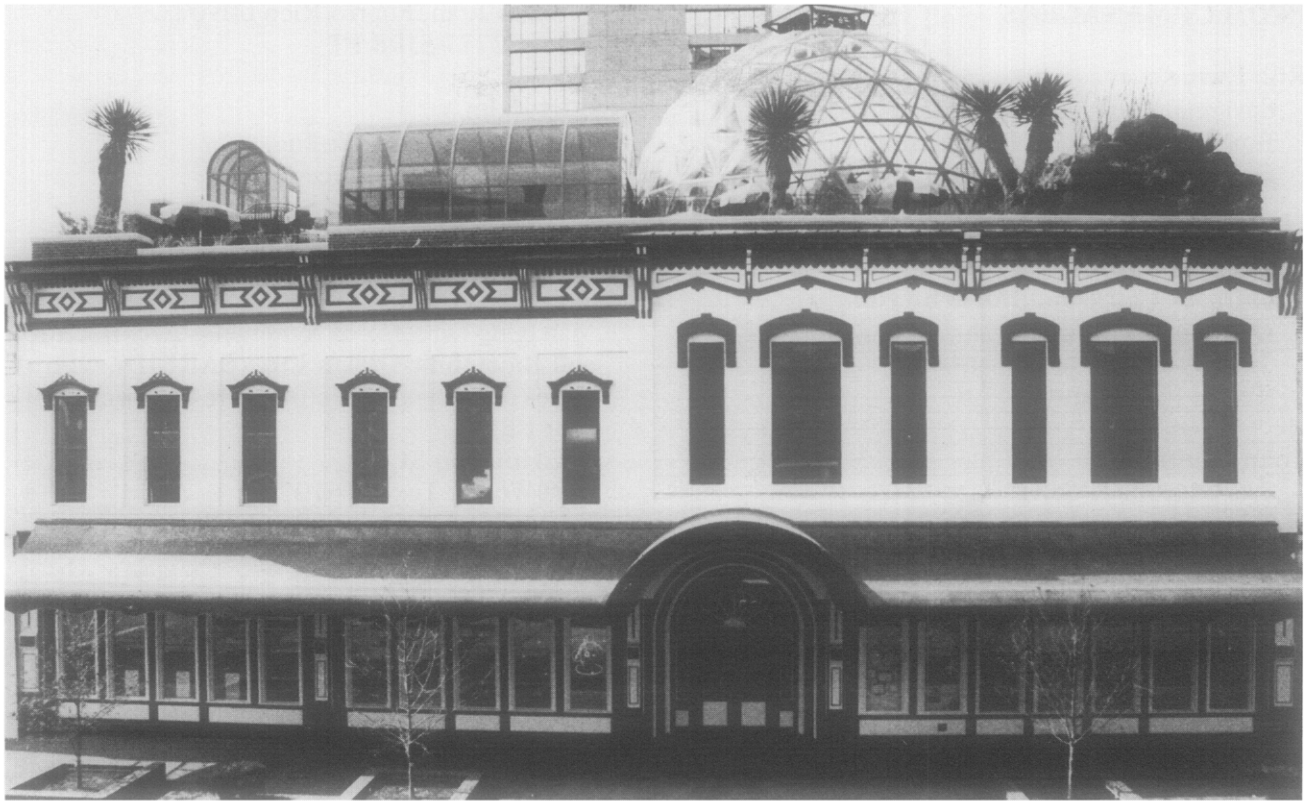

Fig. 21. Caravan of Dreams Performing Arts Center, Downtown, Fort Worth, Texas.

produce a cost-effective discipline to develop a reliable method for creating nodes of an ecosphere that must be born to synthesize the increasingly deadly opposition of biosphere and technosphere. Humans now have the opportunity and probably the obligation to take their part as creative collaborators with the forces of evolution. We should learn how to act it well.

Fig. 22. Inside Desert Dome: front right, an outstanding sample of *Didierea trolli* from the Malagasy desert.

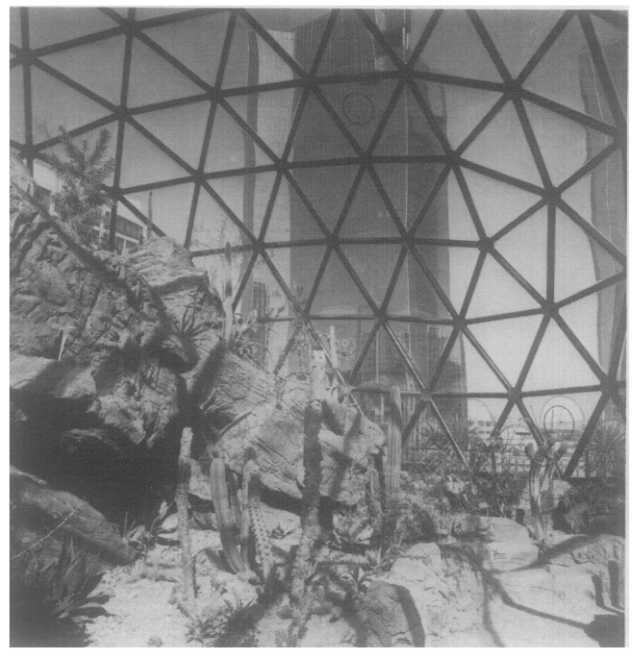

Fig. 23. Dome designed for city-scape.

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