9,600 MILES THROUGH THE U.S.A. IN A STATION WAGON

BY

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Illustrated by photographs taken by the author
(EXCEPT WHERE OTHERWISE STATED)

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Self (left) with my travelling companion, Miss K. Carnley

Photograph taken in England by Mr. George Trevelyan)

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FOREWORD

This account of a tour in the U.S.A. was originally written as a personal and intimate report to fellow members of the Soil Association, and appeared in five instalments in that society's quarterly journal—MOTHER EARTH. The present reprint has been issued because of a demand both inside and outside Soil Association membership. It may therefore now reach a wider public, and for the sake of new readers who are not members of the Association, a few words of explanation may be helpful.

The Soil Association is a world-wide, non-profit making, non-political, non-sectarian, voluntary body with headquarters in London. Registered in 1946, it now has members in 45 countries. The official objects will be found on page 111 and an application form for membership on page 112.

From 1947 to 1954 the Association assumed responsibility for the conduct and management of the long-term farm-scale nutrition investigation known as the Haughley Farm Experiment (information about which is available on application to the London office). In 1954 this important piece of research work was handed over to the Ecological Research Foundation, an independent body promoted by the Soil Association. (A memorandum on this also is available on application.)

It was as representative of the Soil Association that I toured part of the U.S.A. in 1951 and again in 1953, and in writing my report for circulation to its members I have taken a certain attitude of mind for granted which, for other readers, perhaps needs stating.

A glance at the Association's objects on page in will indicate, not only the exceedingly wide field covered, but also that the Association's approach is positive rather than negative. It believes that new knowledge will be gained through ecology (the study of inter-relationships—or wholeness), rather than through continued fragmentation.

A study of wholeness leads inevitably to a new attitude towards life itself, for when the universe is seen as a whole, Nature is seen as being governed by the laws of Order and Inter-dependence, and survival is seen to depend on biological balance, not on cut-throat competition, for the part is not greater than the whole. Throughout Nature a complex biological balance exists between all living organisms, as well as between each and its environment. The lesson we have to learn is how to discover and interpret the part which all other life plays in the whole, and how to co-operate with it.

Our ignorance about Life is at present profound. Those who believe in Wholeness know that we can increase our knowledge only by admitting ignorance, by cultivating humility, by enlarging our field of vision through learning how to observe ecologically, and by respecting all life rather than wantonly destroying it; by learning to use science to interpret, and work with, natural processes, instead of providing inferior substitutes for them, and by acknowledging that within natural laws Divine Law is manifested.

E.B.B.

9,600 MILES IN A STATION WAGON

EVE BALFOUR

Part I. Introduction and General Impressions

Purpose of the Trip

My 1953 trip to the United States differed from the one I took in 1951 in two major respects, namely—its primary purpose and its mode of transport.

My visit in 1951 was exploratory. I wanted to find out three things: what was actually happening in America in fundamental nutrition research ("the relationship of soil, plant, animal and man"); the methods by which the principles of organic farming and gardening were applied under conditions so different from anything of which I had first-hand knowledge; and, finally, whether there was enough general interest in those things for which the Soil Association stands to make it possible for me to earn my travelling expenses by lecturing.

The venture was highly successful. Arising out of it, the primary purpose of my return in 1953 was to visit some of the men engaged in research whose work I had learnt about in 1951. I particularly wanted to discuss matters of mutual interest with those whose research work appears to have an important bearing on Soil Association findings, whether at our experimental farm at Haughley, on members' own farms and gardens, or in the private practices of some of our medical members.

Needless to say, I could not hope, in three months, to visit all those of whose work I heard in 1951 (and I have since heard of a lot more), but there were certain key places in the pattern of investigation I had mapped out for myself which I felt could not be omitted. These were :—The State Experiment Station in Florida, because of its work on the relationship between mineral availability and organic matter; the Texas Research Foundation at Dallas, because more work has been done there than anywhere else I know of, on the study of food contamination with DDT and other insecticides; Dr. Cocannouer in Oklahoma, because of his experience as a practical ecologist; Dr. Pottenger, and other members of the Academy of Nutrition, in California, because they have related soil fertility factors to human health; and Dr. Albrecht at the University of Missouri, because of his work on trace elements, and on the quality of proteins.

Planning the Trip

A glance at the map of the United States (see page 56) will indicate the magnitude of the task I had set myself in planning to visit these widely scattered people. It would involve nearly 10,000 miles, and it would take a lot of lectures to pay the travelling expenses of such a trip—by whatever method I travelled.

I decided that the only way it could be done was to drive myself by road; and wherever I had to sleep, there—if I was invited to do so—I would speak. The key places mentioned above determined the route, and it took quite a bit of planning. The starting point was to be Lancaster, Pennsylvania, because, through the connection of one of our members with the Garden Spot Motor Company, I was able to arrange to rent a reliable car. From there the route would have to go south through the States of Delaware, Maryland, Virginia, North and South Carolina and Georgia to Florida; thence west, through the southern edge of Alabama, Mississippi and Louisiana, to Texas; thence north-west via Dallas to Oklahoma; then back again to southern Texas, across the full length of that enormous state, across southern New Mexico and Arizona to South California; thence north-east via northern Arizona and New Mexico to Denver, Colorado; then due east across Kansas to Missouri; and finally through Illinois, Indiana and Ohio, back to Pennsylvania.

A formidable programme, and only three months to do it in! Could it be done? That was what I had to decide in the few weeks between hearing that I could rent the car and the date chosen for sailing. A friend in America sent me a set of U.S. motoring maps. From these I was able to work out mileages and see approximately where the stops would have to come, allowing up to 200 miles a day in the North, 300 in the South-East and Mid-West, and 400 in the Mid-South and South-West.

I decided that the plan was possible provided that—(a) no breakdown or other unforeseen delay occurred, (b) I had a companion who was used to touring with me and knew the routine of meetings so that I could mentally and vocally relax while driving, (c) that it proved possible to get private hospitality at the majority of the stops, and (d) that I got enough lecture invitations to earn the necessary dollars to cover expenses. I was prepared to gamble on (a), and (b) was solved by my well-tried caravan partner, Miss Carnley, volunteering to come. Air mail letters then began to fly back and forth across the Atlantic to test the prospects as to (c) and (d).

The car that did the job, and my partner. Taken in Oklahoma.

It was quickly obvious that there were likely to be more invitations to lecture than I could fulfil, and the problem of hospitality was solved beyond my wildest dreams. I have the great advantage of membership in three international societies. The first, of course, is the Soil Association. The keenness of United States members is such that whenever a member lived anywhere near one of our stopping points, hospitality was offered before it was asked. Next is my membership of the A.C.W.W. (Associated Countrywomen of the World). This is the international body to which all national farm or village women's organisations the world over are affiliated (Women's Institutes in England and Canada, Home Demonstration Groups in the United States, Country Women's Association in Australia, etc., and their equivalent in non-English-speaking countries). It is a very fine organisation which, incidentally, provided the United Nations with its definition of food as something to eat and not something to gamble with, and also its definition of health as a "state of complete physical, mental and social well-being and not merely the absence of disease or infirmity". Because of my membership in the A.C.W.W., its headquarters in London was able to arrange hospitality for us on farms at several stops.

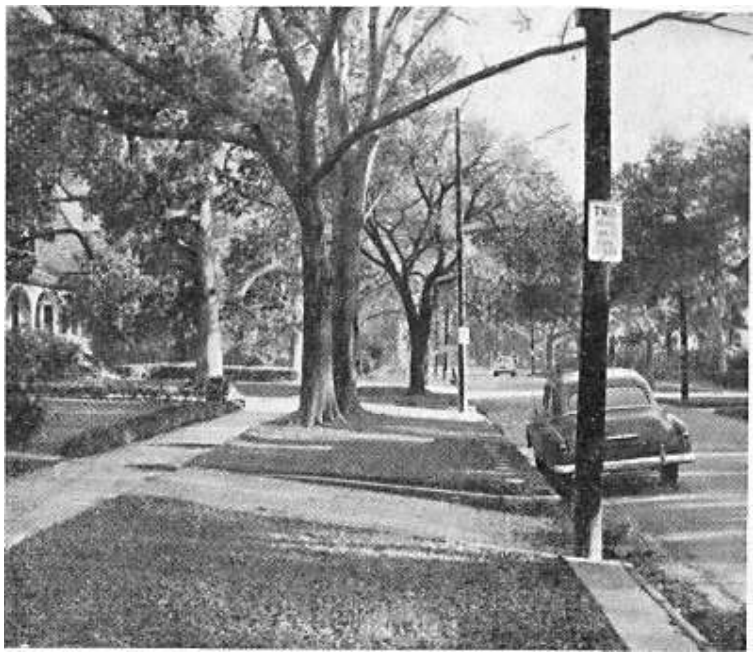
Last, but not least, I am a member of the London Club of Altrusa International Inc. This is the first executive and professional women's service club and was started in America in 1917. There is now a club in almost every town and city throughout the United States, and when neither the Soil Association nor A.C.W.W. could offer hospitality, Altrusa could and did. We were to find that the kindness of these clubs was beyond belief and it was a very great privilege to

meet so many of the profoundly interesting business and professional women who form their membership.

Thus all the difficulties appeared overcome and the venture was on. Much work, however, still remained to be done—work which was not helped by the destruction by fire of my office and its entire contents, which occurred about this time.

The next bit of planning involved fitting into the fixed framework as much as was possible of the other purposes of the trip. These were: to visit organic farms and gardens; to make a further study of soil conservation, and to discuss our project for the formation of the Ecological Research Foundation (E.R.F.) with agricultural scientists, ecologists, and business men, in order to secure their interest, their constructive criticism of the proposed set-up, and, at the appropriate time, their active support. To this end, important appointments were made for me with various people in New York and Chicago, and visits to more scientists and universities were added to the programme, which consequently got fuller and fuller.

All that was left of my office after the fire



A street in New Orleans, outside our hostess's house

Some of the extensions to the original routing were made before I left home, such as the northerly detour between Missouri and Illinois into Iowa to fulfil a lecture engagement and visit our old friends and members, the Treichlers of Walker (whose name, I must mention at this point, I was horrified to find had been inadvertently omitted from the U.S. edition of the Soil Association's "Question Mark" leaflet which we distributed at meetings). Other extensions were added only after we landed, such as 36 hours spent in south Florida (a trip made possible by the generosity of our members Mr. and Mrs. E. Raney, who now live there, and who sent us round-trip air tickets from one of the airports in north Florida), and the final New England portion of the trip. This was a whirlwind lecture tour which necessitated letting our boat leave Boston without us and catching it up later by air in Newfoundland. In five days I spoke in Massachusetts, Vermont, New York State, New Hampshire and Rhode Island!

Only one item on the schedule, as sent to United States members, was cancelled, namely the flight from Oklahoma into Arkansas, though a few details of routing underwent last minute changes.

On arrival in the States I found that my American friends were appalled by my schedule and declared that it could not be done. Now that it is over and has been a success in every respect, I will confess that I think it would be unwise ever again to tempt Providence to the same extent. The schedule was so tight that even a puncture could have -thrown it out and any breakdown of car or health would have blown it sky-high. All went without a hitch, however. We only missed one engagement and that was due to the return 'plane from south Florida being two hours late. Apart from this, we were dead on schedule all the way. Between February 12th and April 18th I drove the 1951 Ford station wagon (shooting brake in England) 9,600 miles, not only without an accident, but without seeing one. We did not have a single puncture or even have to change a plug. I spoke an average of two nights out of three, and though we only twice spent more than two nights in one place, we both kept fit (except for a head cold of very short duration caught in Chicago). Not bad going with our combined ages well over a century! Providence was, of course, very kind to us. We missed all the storms (except one duststorm), though tornados both preceded and followed us. I now feel the tragedy of those death-dealing hurricanes in a very personal way, having visited the districts where they have occurred.

We saw what we went to see, and met those we went to meet. We enrolled a lot of new members and made a lot of new friends. We earned our expenses, and, above all, we acquired a great deal of new information of first-class importance. I now have the task of digesting the items of information and the many impressions which I gained so that they may be assembled and reported to you all through *Mother Earth.* This will take time, and the result will have to be divided into instalments of which this Introduction, written on the boat coming home, is the first. Later instalments will be arranged according to subject and will deal with what the trip taught me of—

(1) Conservation, including municipal waste utilisation
(2) Organic farming and gardening, with special reference to biological pest control.
(3) Agricultural and medical research and opinions

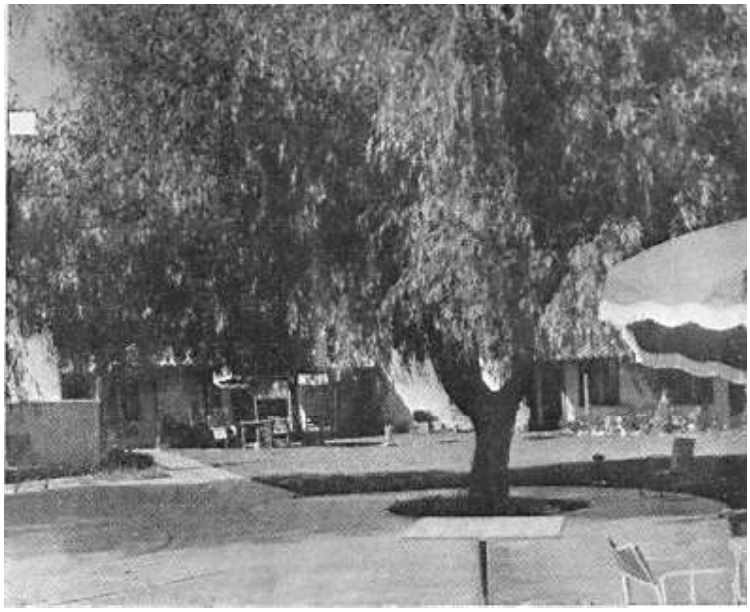
In the meantime, here are some general impressions. I would like to preface them by saying that, crossing the country at the speed we crossed it, an average of 300 miles a day, and the necessity for always using main roads, we could gain only a very superficial view; but it was less uninformed than it would have been if we had not had the benefit of private hospitality all along the route. This enabled us to discuss our impressions each night with people on the spot who knew local conditions and local problems. We were thus able to check our observations, have them corrected when they were at fault, explained when they were puzzling or unfamiliar, and generally put into some sort of perspective. I can never be grateful enough for this privilege.

Virginian farmhouse near Charlottesville. Date 1750. Home of our hosts, Mr. and Mrs. Bradley

Housing and Highways

After my 1951 trip I wrote that America was a land of extremes and that in England we had nothing as good as its best, or as bad as its worst. Among other things, this is most certainly true of highways and housing. Most American domestic architecture is delightful. The predominating building material is wood, and the houses not only have great charm and beauty, but are so admirably well-planned and labour-saving. In this respect, and in general comfort, the small family home in America is far ahead of its English equivalent; but as usual one can find the other extreme. Some of the dwellings inhabited by negroes in parts of the South resemble tumbledown chicken-houses; they do not even have windows. This situation is, I understand, steadily improving.

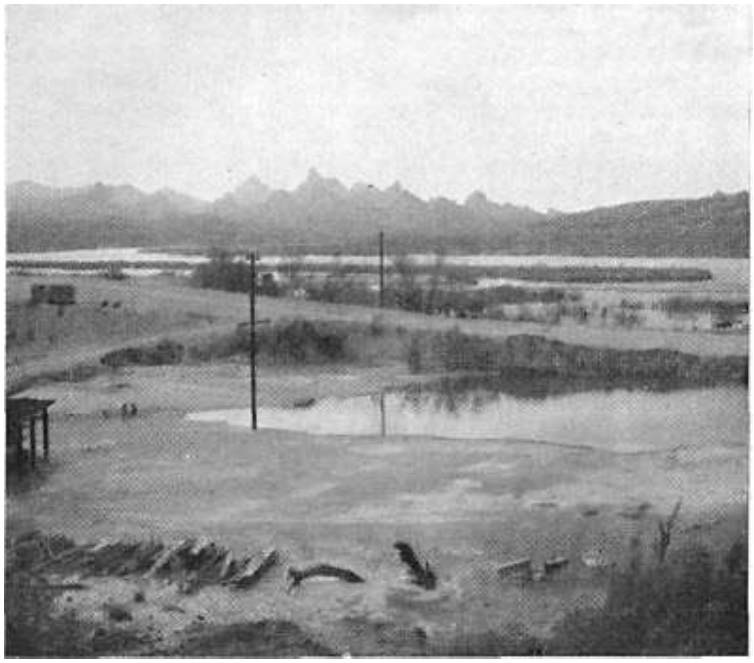
Main roads in most States are something to marvel at. Parkways (one-way divided highways with from two to four lanes per side, i.e. you may have eight cars abreast) now extend over great distances the Pennsylvania Turnpike, for example, for 375 miles), with every crossroad a flyover (or under) and every entrance or exit a "cloverleaf". Other main through roads are just as wonderful in their way, for the surface is so good, every corner so beautifully graded, and the safety devices so well conceived, that there is little excuse for the number of accidents that do in fact occur (that we did not see one in 9,600 miles astonished all our American friends).



Sleepy Peppers inn, Tucson, Arizona. A charming place to stay. Owned and run by our hostess, Mrs. Sloane, and her husband

These roads enable one to cover thousands of miles at an average of 50 to 60 miles per hour with no effort and in perfect safety. Yet every now and then, even on these main highways, the paving suddenly comes to an end, and for stretches of from one to twenty miles you crawl and bounce and thread your way round and through and over potholes up to a foot deep. These sections are usually heralded by a large notice which reads: "CONSTRUCTION AHEAD. A SIGN OF PROGRESS. PROCEED AT YOUR OWN RISK." We came to dread these "Progress" notices, as we called them, for we knew that they meant that for an unknown period we, at least, would fail to progress; and, as we had no means of knowing when they were coming, they sometimes threw out our time-table rather alarmingly. Many of the country roads, of course, are still unpaved "dirt" roads, raising clouds of dust in

summer and seas of deep, liquid mud after rain. But when the size of the country is taken into consideration, the surprising thing is the tremendous mileage that is paved, and beautifully paved at that.

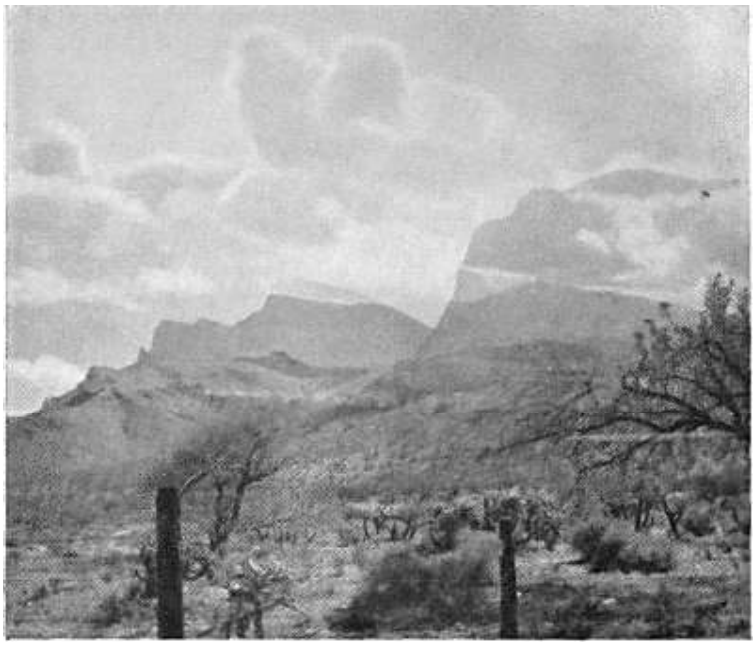


The Needles, N. Arizona, showing the Colorado River after it leaves the Grand Canyon

The Country

The size of the United States has to be experienced to be understood. Even though one knows that New York is nearer to London than it is to Los Angeles, this really means something only when you have crossed both the Atlantic and the country at approximately the same speed (in terms of miles per day). The country contains six distinct climates. We saw the arrival of spring three times over. In 1951 the unusual experience, which made the most vivid impression on my mind, was my first sight of fireflies. In 1953, it was one day's driving, from Atlanta, Georgia, to Jacksonville, Florida, a distance of 380 miles. It will for ever be to me a drive, not through space, but through time. In terms of the English seasons, we drove from February to June in a single day. Though it had been fairly warm and spring-like in Atlanta, the trees were still bare and only the earliest flowers were out. As we proceeded, first the buds began to appear on the trees, then the tender green leaves, then they emerged more and more, until at the end of the day everything was in full leaf and full flower, and it was summer. It really was an extraordinary experience, rather like living in one of those "time-lapse" films speeded up to show the growth of plants.

Besides six climates, the country has every type of scenery from tropical to arctic; but each type lasts for such a long time that you do not get the same sense of variety as you do in England. We drove for three days through forests, three or four days across treeless flat plain, nearly two weeks over mountain-ringed deserts, much of it a mile above sea-level, and a week over undulating rolling plain, some of it quite reminiscent of parts of rural England. For example, we would remark to each other, "This is rather like Cambridgeshire" or "This is quite like the country round Tring"; but the country round Tring lasts at most for half-an-hour's driving, while its counterpart in America lasted all day.



High altitude range country, S. Arizona

We found that few people we met had seen so much of the States as we had, yet we only saw a small part of thirty-one States out of the total of forty-eight. We were frequently asked which State we liked best—an impossible question to answer; for it depends on the time of year you visit them and the point of view from which you are judging. From an agricultural point of view I have seen nothing to beat parts of Pennsylvania; for winter climate I pick Arizona; for beauty of the more intimate kind I have still seen nothing I like better than Virginia, though the Carolinas run it close; for the grander type of beauty the high Arizona desert was the finest of anything I have yet seen; for grotesque and awe-inspiring natural phenomena, New Mexico; for mountains, Colorado and California. I was fascinated by Texas, not because of the scenery, though some parts I saw were very beautiful, notably round El Paso, but for the people. There is a panache about them which I found entrancing. Temperamentally, it seemed to me that what the Breton is in France, the Texan is in America. I dropped a bad brick in Texas, however. In all innocence I commiserated with those unfortunates who are condemned to live within the range of the odours of one of the many oil towns (we had to shut all our car windows when driving through). With a puzzled and slightly contemptuous look, I was told "They don't smell bad to us". I had forgotten the dollars they represent! Iowa and Illinois stand out because of their systems of mixed farming—rare in the States—but every State we visited had its own special charm and beauty spots (though too often marred, alas, by roadside advertisements and unsightly dumps of litter) and the more I think back on the rich variety offered by that great country, the more I marvel that Americans ever bother to cross the ocean for their holidays.

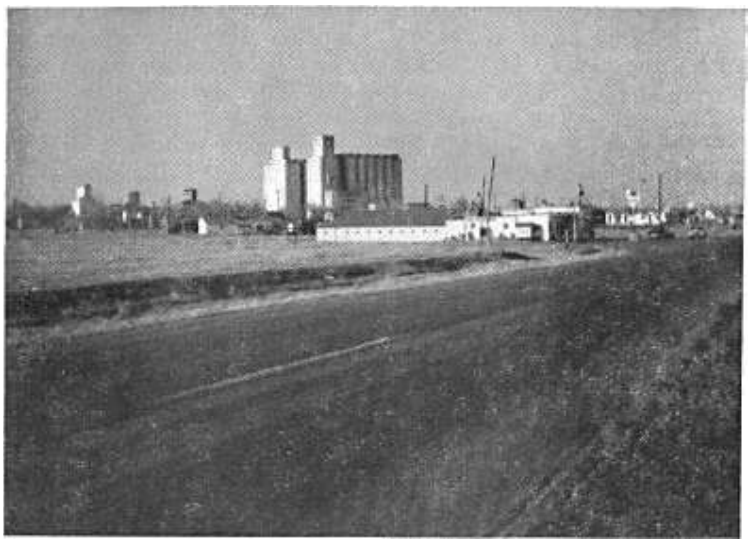
Several things surprised me. I expected the deserts to be monotonous; every mile of them was fascinating, and full of changes of colour of indescribable beauty. I had no idea that South East Texas possessed such a large forested area (it was here we saw wild boar). I expected the wheat belt of Northern Kansas to be dead-flat and treeless; but it is undulating, rolling country, almost downlike in places, and with many trees. Every visit I make to the States whets my appetite to see more.

Mesquite bushes, S. New Mexico Mesa 17

The People

Americans are citizens of a continent rather than of a country and it is no more possible to generalise about the one than the other, but they have certain characteristics in common. Their local patriotism is to their own State, as it should be. They are all slightly disappointed if you do not think their particular State is the nicest. They are the warmest-hearted people on earth and exhibit a kindness which is not just good manners—though they have beautiful manners—but springs from a deep-rooted and genuinely interested friendliness. This was our universal experience, not only with those we met socially or professionally, but with all with whom we came in contact along the highway, such as waitresses, garage hands, anyone of whom we might ask the way, or a casual acquaintance met in a cafe.

Typical example of roadside litter



Typical wheat town in N. W. Kansas, dominated by grain silos

There is a great deal of ignorance among Americans about Great Britain and the British Commonwealth, but this is not greater than the average Englishman's ignorance about America. We were surprised and touched by the genuine interest and affection shown everywhere for the Royal Family. We were also impressed and cheered by the trend among ordinary citizens away from materialism. To offset this, it is a shock to find, in a democracy that prides itself on its freedom, the lengths to which commercial oppression can go and get away with it. It is truly remarkable, and rather disturbing, to see the extent to which the American people can be hoodwinked by advertisement. Even among those who are not, I have seen much evidence of what I can only describe as a fear psychosis resulting from the power of big industrial corporations. The same situation exists in England, no doubt, but is much less evident. I suspect that a lot of the power is bluff, but it takes a lot of dollars to call the bluff. As the English judge once replied to the statement that English justice was open to everyone—"So is the Ritz".

Everything in America, as I remarked once before, is on a big scale—both the good and the bad; but my predominating feeling after a visit there is always one of hope. Analysing this feeling, it is, I think, because apathy is so rare. Americans feel, and because they feel, they act—not always wisely, but who does? If their mistakes have been big—like their exploitation of the soil—so are their efforts to right errors once they are aware of them; and, above all, they are not afraid to acknowledge them. There is no critic of America so severe as the American himself. One of our hosts was an isolationist. Since I feel very strongly that the future existence of the world as we know it, and any hope of ever bettering it, depends on the closest co-operation and partnership between all freedom-loving peoples in general and our two countries in particular, isolationism is naturally an attitude I deplore; but our host's reason for holding it made a great impression on us. He said he was an isolationist because America had made so many mistakes at home that she should set her own house in order before telling other countries what to do. This self-criticism, so long as it is accompanied by a proper national pride, is an endearing trait which I am proud to believe our two countries have in common. May this long remain so.

The overall health picture of America is bad. There is much sickness and much malnutrition. Americans eat too much, and of the wrong things. Food is even more over-processed and sterilised than in England; much of the soil on which it is grown is more depleted; and there is an even wider use of poison sprays. The daily dosing with vitamin and mineral pills—in an only partially successful attempt to correct the effects of faulty feeding and of what those who

know call "foodless food"—is almost universal. Children frequently look strained and pasty. In maternity hospitals, I was told, mothers are urged not to breast-feed their children, because the quality of the milk usually fails to nourish the child and the effort weakens the mother.

A happy contrast to this rather gloomy picture is the robust health of the "whole food" eaters, and their numbers are increasing. So are those of the doctors now basing their practice on preventive medicine through proper nutrition. I shall have more to say about their findings in a later instalment.

In a brief summary this is as balanced a picture of my general impressions as I can give. I hope at any rate that it has made one fact abundantly clear, that I love America and her people.

PART II

Conservation

In Great Britain the word "conservation" is only occasionally heard in everyday conversation, and it is little understood. In the minds of many people it just means contour ploughing and is considered to be unnecessary under British farming conditions. There is a two-fold error here. That conservation is badly needed in this country has been shown in previous numbers of this Journal (especially Spring 1950 and Spring 1951) and will clearly be demonstrated by an article from Mr. Farrant, to appear in January 1954. Contour ploughing is obviously one of the methods which should be employed in many cases, but the very fact that this particular technique has become necessary is usually an indication that a considerable decline in fertility, with its accompanying loss of soil structure, has already taken place. In other words, it shows that, for many years, conservation has not been practised.

What then is conservation? Quite simply, it means proper land use, coordinated over a whole natural drainage area from watershed to the sea, and involves the planned preservation of all the natural resources of that area—forest, water, soil and wild life—for what injures any one of these four, injures the others. It will thus be seen that conservation is applied ecology, and this is the sense in which the word is used in the United States. This explains why, throughout my journeys in that country, I have always found an immediate bond of sympathy with members of the Conservation Service. I have never yet failed to get on with conservationists. They may not agree with everything we think, they may have quite different interpretations, but this makes no difference because we speak the same language. They are always aware of the important of organic matter, in much more than its merely physical sense, because they are always aware of the importance of life, and through this, never lose sight of the interdependence of all forms of life—in other words, whatever our disagreements on detail, we both have the ecological approach.

When to the American definition of conservation, as the preservation of forest, water, soil and wild life, all conservationists add organic wastes (as a few already do) the problem of feeding the world's growing population will be in sight of solution. In lectures to American audiences, I coined the phrase "total conservation" to cover these five things, for the fourfold meaning of conservation is understood everywhere in the States. It is only for some of our European readers that the above explanation may be necessary.

The Conservation Service in America, although a department of the Federal Government, is without any powers of compulsion. It works entirely by persuasion and education. The establishment of a Conservation Area involves the voluntary co-operation of many people and groups, often of widely divergent interests, for example— farmers, lumber firms, factories, sportsmen, and even everybody who uses the highways. The large number of flourishing Conservation Areas now established throughout the country is a tribute to the selfless devotion of the men in the Service. They are getting increasing support from many other organisations, among whom the best known are the Conservation Foundation and the Friends of the Land. Conservation education is a regular feature now in most schools. The Garden Clubs of America, which has branches everywhere, has a Conservation Committee as part of most of its branches, and there is a new women's organisation called the Conservation Auxilliary, started by wives of Conservation Officers, to do for the Conservation Service what the United Nations Association does for the United Nations. All this is excellent and is having a marked effect. In contrast, it is distressing to find that in some cases the Agricultural Extension Service (equivalent to the Agricultural Advisory Service in

Britain), far from backing up the Conservation Service, is actually obstructing it. It is not for me to suggest why this should be so.

The Brandywine Valley Association

The best all-round co-operation is being achieved in those areas where a Valley Association is in existence. These are now springing up all over the country and are all modelled on the Brandywine Valley Association which started operations in 1947. The moving spirit of this fine pioneering enterprise was, and is, Mr. Clayton Hoff, the executive director. The following quotation is taken from a reprint of an article by William S. Dutton, which first appeared in the Saturday Evening Post (16th August, 1952) and is now issued by the Brandywine Valley Association as an illustrated brochure describing the project and its achievements. There is room in Great Britain for similar organisations.

> "In effect, the valley associations are new non-partisan political units of unique character. They are formed along lines drawn by geography and common local interests, rather than those of counties and states. Most Americans live in river valleys or watersheds. Life and trade flow with the valley's streams, with little regard for governmental divisions. The water supply is the valley's economic blood upon which farms, industries and towns are alike dependent . . . It follows that the valley associations vary as dictated by local needs. They range in size from tiny Honey Hollow Creek's, near New Hope, Pennsylvania, with six farmer members, to ambitious movements in many states to unite all the watersheds of a river basin. . . . In the Missouri Basin, ravaged by floods last year and now bitterly in controversy over a further vast flood-control system proposed by the Army Corps of Engineers and the United States Bureau of Reclamation, skeptical taxpayers are organising locally by valleys and amalgamating in opposition throughout Iowa, Nebraska and Kansas. Before any more big dams are built downstream, they want flood-prevention measures put into effect in the uplands. They insist that effective control must begin on each mismanaged farm and eroding hillside.
>
> "Hoff sees two main reasons for our failure to manage soil and water. One is local indifference and ignorance, the other is confusion and jealousy among official control agencies. A directing force has been needed to get warring county, state and Federal experts working together instead of at loggerheads, and he thinks it has been found in the small watershed movements, of which the Brandywine Valley Association is typical."

Given an executive director with the vision and drive of Mr. Hoff, I am convinced that this new movement is the answer in America and could be here, too. We were very fortunate that our long 1953 trip in the United States started with a tour of the Brandywine Valley Conservation Area with Mr. Hoff himself as our guide. The East and West Brandywine Rivers, which flow into the sea at Wilmington, Delaware, have their sources well into Pennsylvania. The territory covered by the Association goes inland almost as far as Lancaster. The rivers and their tributaries wander for 60 miles through mainly good farming country. All types of industry and farming and forestry are in the valley. Wilmington's water supply rises in the hills. There are some 2000 farms, and the valley provides water for one of the biggest steel works in America. There are also many paper mills. In the old days there were small, water-operated mills every few miles, mostly for grinding wheat, the flour being shipped from the Delaware ports. Mr. Hoff's interest in the river and its problems began when his business took him to Wilmington in 1937, and he did eight years of propaganda with camera and meetings before the Association was formed and concerted action took place.

The situation, as he found it, was indeed serious. Raw sewage and factory wastes had almost depopulated the stream of fish. Soil erosion from the farms had so silted up the great port on the estuary that an Army Engineers' dredge had to spend several months each year pumping rich topsoil out of the ship channel. This is estimated to have cost the taxpayers $300,000 a year; and the loss of topsoil is considered to have represented a total loss to the valley property owners of three times that amount.

All the many interests involved had gradually to be won over. Today the Association includes in its membership 1,200 representatives of almost every bank, farm group and business of consequence along the Brandywine. As soon as a sufficient number of people agreed to come into the scheme, the first step was to

get the valley registered at Washington as a Conservation District. Subsequently, the function of the Association, apart from continued education, has been to put each new group or individual, whether farmer, factory or forester, in contact with the appropriate Conservation Advisory Service and then to see that both do their job and keep their side of the contract. The achievement in five years of operation has been staggering. The total run-off of water has been reduced 40%, and the amount of silt in the water reduced 75%. Pollution has practically ceased and fish are coming back into the streams. Forests and farm wood-lots are being properly managed and maintained by selective felling and natural regeneration. Around 220 complete farm conservation plans are being completed yearly, and 150 farm ponds have been built in one county alone. Marshland areas have been formed under proper management for preservation of wild life and water.

Recognition of the importance of wild life is one of the nicest features of American Conservation programmes; preservation is fostered by no means solely for sporting, still less for sentimental, reasons, but for ecological and hence economic ones. I have space for only one example, but hope to give others at a later date. On a certain farm, a beaver-created swamp covered 20 acres. Surrounding it, was another 40 acres of hay pasture. The farmer argued that if he killed the beavers and drained the swamp, he could have 60 acres of hay. He did this, whereupon the water table dropped, and he ended by getting less hay off the 60 acres than he had previously harvested from 40. He brought back beavers. Swamps and hay yield were both restored. In another case, a pair of beavers, two years after being loosed, built a dam that could not have been built by men for under $2,500. The skill and industry of beavers can be seen in the photograph I took of a beaver-felled tree in Mr. Treichler's wood-lot in Iowa. These animals fell a tree in the direction in which they want it to fall, as accurately as a skilled forester, first clearing any smaller growth likely to intercept the bigger tree when it falls.

One of the features of forestry management in the Brandywine area is the formation of a private co-operative company among farmers, Woodlands Products Inc., for the proper marketing of their wood-lot products. It has a modern sawmill, started practically without capital, which now has assets of $50,000, handling $75,000 worth of products annually. These products include fencing material, farm gates, tools, etc., all made from the farmers' own wood.

In the first instance, soil conservation involved a return to mainly grass farming till erosion gulleys were healed. The stock-carrying capacity of this grassland steadily increased. Some areas are now once more under cultivation, managed on a system of strip cropping and contour ploughing. Before this conservation work started, the average farm income was $97 an acre; it is now $192 an acre. The average yield of corn (maize) was 40 bushels an acre, it is now no bushels an acre. There is one farm of 100 acres, once worn out, which now has an income of $16,000. The 1950 census showed that in Chester County the annual farm income has increased by almost $8,500,000—and all this in five years.

The job is not yet complete. Mr. Hoff himself says it is half done and there are still some bad spots, neglected hillsides that still remain to be tackled, and so forth. When these badly eroded hillsides are abandoned, a kind of yellowish grass develops which is called "poverty grass". To look at, it is rather like English barley-grass, only deeper in colour. It grows about two to three feet high, but provides little protection against further run-off of water and erosion because it grows in clumps, and gulleys form between them. The method of tackling such hillsides is first to disc down the grass and sow rye. This is then allowed to develop until it is fully mature and has shed its seed. It is then disced down again and a fresh crop comes from the self-sowing. This crop is disced or ploughed down in the green stage and at that point the real first agricultural crop is sown. This discing is, of course, combined with terracing, and all done on the contour.

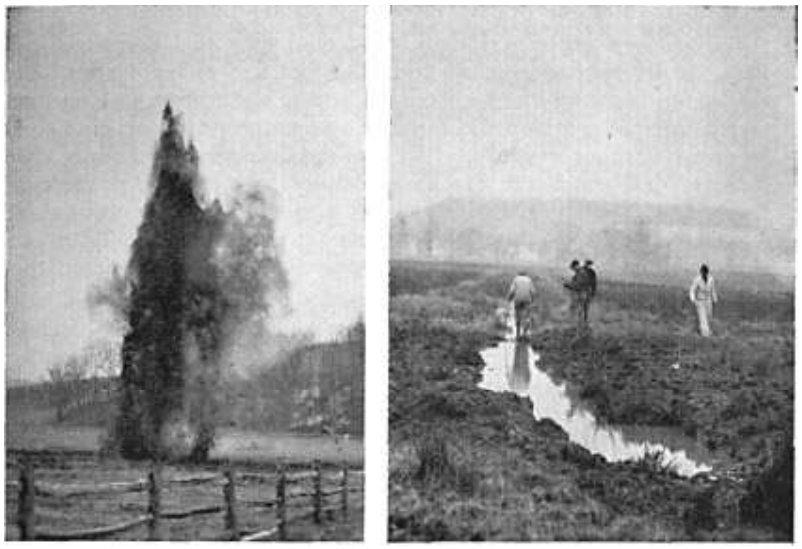
Tree felled by beavers

There are a few exceptions to contour cultivation. Some of the farms in the area are Amish farms. This sect is a branch of the group known as the Pennsylvania Dutch, and they have always stuck to horses or mules for power. This, among other things, has given them a much more plentiful supply of farmyard manure, and they use organic matter so heavily that there is no loss of soil by water erosion, even on quite steep fields and even in the absence of contour ploughing. We crossed one of these farms in the course of our tour and it was a lovely sight. Bare soil was not visible anywhere. Where no crop was growing, it was either coated with a good layer of vegetable trash, or had a heavy application of farmyard manure upon it. Mr. Hoff told me that in the early days, when he was visiting all the farms in the area to persuade them to come into the scheme, he suggested contouring to one of these Amish farmers, who said that he had nothing against it. If he saw any signs that he was losing topsoil, he would certainly contour, but he saw no point in doing so if there was no need. Mr. Hoff admitted that there was, in fact, no need. He had been over the farm after the heaviest downpours of rain and there was no run-off of any kind at all! This does go to show, as I said earlier, that the necessity for contouring, except under special physical and climatic conditions, arises only after loss of soil fertility has begun.

In the early days, one of the greatest problems in stopping the water pollution was the papermills. The effluent from these factories, and the dyes used, caused very serious pollution, and the equipment necessary to prevent this costs $20,000; so you can imagine that some considerable degree of persuasion was required to bring mill-owners into the scheme. Mr. Hoff's method, as he described it to me, delighted me. He would go with his colour camera to one of these mills and ask the manager for permission to photograph the brilliantly coloured water in the stream. The answer usually was, "Sure, go ahead"; then, as an afterthought, "What do you want it for?" "Oh", said Mr. Hoff, "publicity!" The manager then, slightly nettled, would say, "What are you going to do? Show folks what I am doing to the stream?"; and Hoff would reply, "Could be! But I am hoping to show them what you are going to do to the stream." I think that story both sums up his genius and explains his success.

One of their worst remaining problems is river bank erosion. The Conservation Service always recommends the straightening out of the whole river

course to avoid this, but the members of the Association are against this method, partly because it spoils the beauty of the valley and also because it completely destroys the fishing. So they are dealing with it by getting the right kind of willows or bank plants to grow along the edges to hold the banks. This is proving successful, but is rather a slow method. We visited an area of low meadows that were being drained, the first operation being the cutting of a ditch. This was being done by blasting, which struck me as a slightly laborious method, for it involves a charge for every few yards. It was interesting to see, however, and the photograph taken by Mr. Hoff on that day and, incidentally, in a snowstorm, shows very clearly how the method works.



Cutting ditches by dynamite (Photographs by Mr. Clayton Hoff)

I was interested in the order of priority given to the different phases of this work when they first started it. It was soil conservation first, then river pollution, then forestry, and finally wild life preservation. These four having been well and truly launched, they are now turning their attention to my fifth factor, the utilisation of organic wastes, and are studying how a composting system could, in due course, bring back to the soil the garbage and sewage of the valley. Sawdust is already being fully utilised.

It was a most instructive and thrilling day, and we have to thank for it Mrs. Van Zonneveld, of the A.C.W.W., who organised the expedition.

A Contrast in Conservation Problems—California

We had one other personally conducted tour of a Conservation Area, as different as possible from the first and as far distant—all the way in fact from the high rainfall area of the eastern seaboard to that district of southern California where no crops of any kind can be grown without irrigation. This was the Conservation Area of the Palomar Valley in North San Diego county, with its headquarters at Escondido. The day's expedition was planned by the Conservation Auxilliary, which organisation originated at San Diego, and included a visit to two organic avocado-pear groves. These will be described in Part III of this report.

The problem of conservation in a hot, dry, mountainous climate is very different from that of the eastern states, though both have to guard against gulley erosion because, on the rare occasions when it does rain in the dry areas, the rain falls with tropical force. In the east, restoration of worn-out soils must include some form of mineral restoration, because the sequence of erosion there has been

Alkaline deposit making soil barren and useless

as follows, each stage resulting from the one before. First, destruction of organic, matter through failure to make adequate return; second, destruction of soil life; third, loss of soil stability (the mycelium of soil fungi is the most potent factor in maintaining soil structure); fourth, water run-off, carrying the top-soil with it; and, lastly, with top-soil gone, the washing out of most of the soil minerals. In a dry climate there is little leaching of minerals, and conservation is mainly concerned with water conservation and restoration of soil life. In some areas the highly-charged mineral soil itself poses the chief problem. When these minerals are alkaline, there is always a danger that water, whether as occasional rain or as irrigation, will evaporate before it can percolate, leaving a deposit of toxic salts on the surface. Sometimes the only available water supply itself carries toxic salts. There was the famous incident of the Shadehill reservoir, built by the Bureau of Reclamation on Grand River in Perkins county, South Dakota. The reprint already quoted recounts this story as follows:

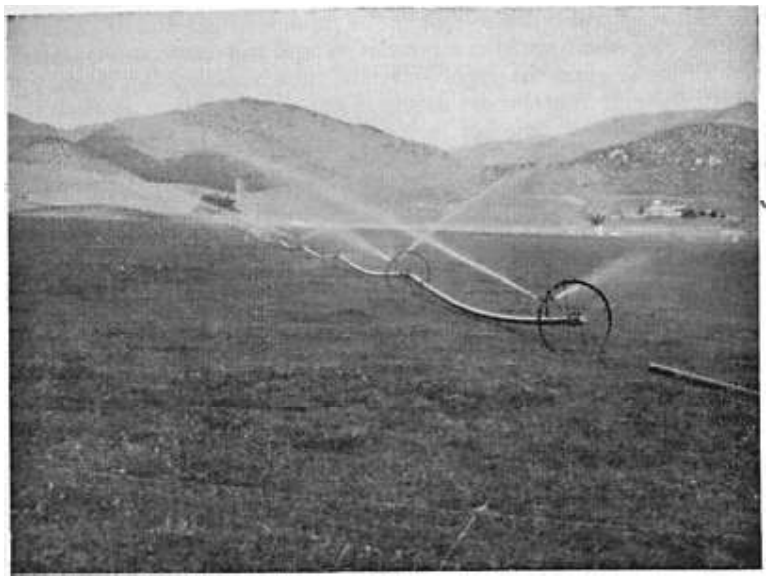
> "The dam, whose major purpose is irrigation, cost $11,000,000. After the dam was completed, somebody decided that maybe local warnings, long unheeded, that the water was not fit for irrigation ought to be investigated, just in case. Agriculturists of the state university, among others, had so warned. Belated chemical tests proved the warnings to be justified. The Shadehill water carries sulphurlike selenium and other noxious elements, and vegetation that absorbs these elements can poison livestock which eat it."

The Palomar Valley Conservation Area is very extensive, and the distances are as much vertical as horizontal, from deep valleys to high mountain tops. In such a situation, diversified farming is a virtual impossibility, and one of the most valuable functions of the Conservation Service is to carry out detailed land surveys to find out what crops will grow where, and to plan land use accordingly. As a result, the flat valley bottoms are used for cattle raising on irrigated alfalfa (lucerne). On the lower mountain slopes the crop is mainly citrus fruit, higher up are the groves of avocado pear, which is more frost resistant. On small plateaux higher still, near the highest mountain peaks, there is, surprisingly, a flourishing strawberry-growing industry; and above that, the highest slopes of all are suitable for olives, though few are in fact grown because of the difficulty of transport from such situations.

All these crops have to be irrigated, and it is a tremendous undertaking. The main water supply is brought very long distances by canal; thence it is pumped into conservation ponds and reservoirs on individual farms and ranches and then from the ponds led to the crops by gravity. In many of the groves, there has to be

a pipe to each individual tree. The grower's capital outlay in pipelines is staggering.

We started our tour by visiting some of the cattle ranches in the valley bottoms. This was useless, arid land growing only desert scrub and sage brush until irrigation became possible; now it is covered by rich, green paddocks under alfalfa, with fine herds of Aberdeen-Angus cattle grazing them rotationally. The alfalfa is established a bit at a time by the following technique. First of all, the desert scrub is bulldozed out, leaving bare soil. This is then enclosed by a fence to form a corral. Cattle are turned into this enclosure, which, when possible, is littered down with straw; and there for a whole year they are fed by carrying to them hay, corn and whatever else is necessary. This makes a good initial layer of organic matter in the form of straw, waste hay and cattle dung. This is ploughed in, or disced in, and sown with a mixed crop of cereals and vetches. When this is in full, green growth, it, too, is disced in; and then, in October, they can irrigate and sow the alfalfa. One farm we saw was carrying 75 head to 100 acres.



Irrigation in the Palomar Valley Conservation Area

The key to conservation on the mountain slopes, whether under citrus or avocado, is soil cover. Mulching plays a great part in this, also sowing down with grass and weeds, which are cut and dropped. A few misguided growers are still refusing to adopt these methods and persist in bare cultivation under their trees. This is done in the misguided belief that any undersown crop competes with the tree for moisture. In actual fact, rightly managed, the reverse is the case. It is another ecological example of two species being partners and not competitors, and the bare groves we saw were noticeably less healthy and productive. Some of the young avocado groves are very high up indeed, on extremely steep mountain slopes. In such situations, soil cover is so important that new plantings are made right in among the native sage and scrub, for it is not safe to disturb the soil at all except for the small hole in which each individual tree is planted. When the trees reach a certain size, the scrub is pulled out by hand along each alternate row (the trees are, of course, planted on the contour), and then grass is sown. When the grass is established, the other alternate row is treated in the same way. By these methods, even on these sheer slopes, there is no erosion.

All the Conservation officers I met at Escondido had the same enthusiasm and fine sense of mission that I have come to associate with conservationists everywhere. They were grand people and can be justly proud of their achievements, for the Palomar Valley have some very special problems and freak

rainfall records. The normal is supposed to be 20 to 25 inches a year, though the whole of this falls within three months. (Every year has a nine months period without rain at all.) That is the normal. At the moment, like many other parts of the States, they are suffering from a prolonged drought. Last "rainy" season produced no rain. But here are three authentic records to show what can happen in that particular district. In one year, rainfall zero inches: in one year, rainfall 90 inches: on one occasion, 12 inches of rain in 90 minutes.

"Big Dam Foolishness"

Before going on to my impressions of conservation progress in general, and some examples of it on an individual level, I must mention one more organised group. This is the Blue Valley Study Association at Manhattan in Kansas. I knew nothing of this till we got there, and we were introduced to it, in the first instance, in a most dramatic way. Approaching Manhattan, we were suddenly confronted by a huge roadside notice with vast letters, which read "STOP BIG DAM FOOLISHNESS. STOP RAIN WHERE IT FALLS." Much intrigued by this, we were not left wondering for long. I had been booked, through A.C.W.W., to speak at a meeting of farm women in Manhattan. There were other speakers at this meeting, among them two members of the Four H Clubs, which is the American equivalent of our Young Farmers' Clubs. A girl did the speaking and a boy showed slides; and quite admirably they did it. They were speaking in support of the Blue Valley Association.

A project is at present under way whereby a dam is being built to cross the Blue River at a place called Tuttle Creek. The work, as is the usual custom, is being carried out by the Army Engineers at an estimated cost, if completed, of $68,000,000. The alleged purpose of the dam is twofold, (i) to check water below the dam and so stop flooding, and (ii) in dry seasons, to release water from the reservoir to help flush the city sewage from Kansas City into the Missouri River and so reduce a nuisance! (How can one separate the conservation and utilisation of municipal wastes from the general conservation programme?) The benefit estimated by the Engineers from this scheme, when completed and so long as the dam remains effective, is $3,000,000 a year; but the result of this dam and reservoir would be to inundate a highly fertile valley which gets enough moisture to grow good crops, including alfalfa. Some 55,000 acres would be flooded, and five small towns and 30 hamlets wiped out.

The citizens are up in arms and, forming their Association, have gone about getting facts and publicising them. One of the facts was that the annual value of the crops grown on the land to be flooded was no less than $6,000,000 a year (at 1947 prices). But they are agitating about it, not only because of the shocking waste involved and the cost of so much destruction, but because of their very sound belief that big dams are not the answer to flooding and water-control generally; for without proper conservation methods on the watershed, to hold the rain where it falls, these reservoirs silt up in a very short time and become useless.

After the meeting, one of the members of the women's group, who was a farmer's wife, took me on a very rapid tour of the area, showing me some of the good farm land that is condemned and the actual site of the dam where the engineers were still busy working on it; but despite this and the cost to date, I believe that the citizens will win their case. I certainly hope they do, as I am sure that right as well as common sense is on their side.

Concerning the general progress in conservation, my impressions throughout our 9,600 mile trip were that this has made great strides in the last two years, particularly in the field of education, which is, after all, where the work must start. This education is being carried out at high pressure by the Federal Government, the Conservation Services, state-sponsored organisations, voluntary societies, and individuals. For example, in Houston, Texas, a Mr. Malone, president of one of the biggest banks, is devoting much of his personal fortune to publishing material for use in conservation education in all the schools in Texas. The state of Iowa runs annual conservation camps for teaching schoolteachers

something of the technique of conservation in actual practice in the field, so that they will be more competent to give classes. The Forestry Service, too, is doing good work. In Florida, when driving through forest country, I photographed a large notice beside one wood which read as follows: "SELECTIVELY CUT. 14.3 CORDS PER ACRE SOLD. A GOOD STAND LEFT. OWNED BY MRS. HENRY RADCLIFFE. CUT TIMBER WISELY, IT PAYS. FLORIDA FOREST SERVICE."

Throughout our journey, whenever the road entered a Conservation Area, attention was called to the fact by a roadside notice saying—"You are now entering such and such Conservation Area". As a matter of fact, for those who had eyes to see, there was no need for these notices. The contrast between a conservation and non-conservation area is as the contrast between a green oasis and a desert. To give just one example, throughout that part of our journey which took us through the Deep South (Carolina, Georgia and into North Florida), the erosion where conservation is not yet being practised is really quite terrifying. This is enhanced by the fact that the soil in these areas is a red clay. I was told that this is actually the subsoil and that the topsoil has gone entirely. Deep, ugly gulleys were everywhere, nothing was growing, every rivulet and stream was turgid, scarlet water. The phrase kept recurring to my mind "the land lies bleeding", for really they did look like rivers of blood. Then from this devastation one comes to the notice and enters a Conservation Area. If it is of recent origin, one can see the early techniques, the contouring and the terraces, and there one sees water standing on the surface, collecting behind the terraces; in other words the water is being held. The next Area one enters may be of older establishment and there one comes into a green paradise, by contrast. The gulleys are healed or rapidly healing, the land is all down to grass or alfalfa, healthy cattle are grazing, and run-off of water has ceased.

By the time all the Conservation Areas have linked up, America will once more be on the road to a fertile land.

How necessary this work has become, was brought home to me when I was told that the average rate of soil destruction had been one farm worn out in each family per generation. This was confirmed by Dr. Nichols (of whom more later), who has described his own family history in the following words—

> "My great great grandfather lived in South Carolina. He had 2,000 acres of very rich land. He was a successful farmer. He made a lot of money growing cotton and tobacco. He built a big house, raised and educated a large family. But when his sons were grown they found the land was no longer making big crops and the farm was no longer making money. So my great grandfather 'went west'. He moved to Tennessee where he found a large fertile farm. He did exactly the same thing that his father had done. . . He was very industrious, worked hard, made a lot of money, raised and educated a big family. When his sons were grown they found the farm had been literally mined year after year and was no longer making a living for the family. So my grandfather moved to Alabama. He got together 2,000 acres of very rich land and here he did the very same thing that his father and grandfather had done. He had a large family. My father was the baby in a family of twelve. ... By the time my father was grown, ... the farm was worn out and he had to move. He moved to Ashley County, Arkansas, down in the Mississippi Delta. He bought a rich farm and the same old thing started all over again.....But by the time I was grown, all the profits from the farm was going to pay for fertilizer and poison spray. So I had to move, but there was no place left for me to go. By this time the whole country had been settled and most of the land exploited."

Now let no English reader be complacent about such stories. In the first place, England must shoulder a large share of the blame, for in those early pioneering days she encouraged by every means in her power the continuous growing of monoculture crops such as cotton and tobacco and their exportation to this country for processing. In the second place, English farmers have no conception of what it means to farm under the climatic conditions which face so many Americans. It is hard for them to imagine what can happen when, after a two-year drought with a temperature for weeks on end of 90 to 100 degrees F and even more, there arrives 12 inches of rain in go minutes. Under such conditions,

our soil would be gone as fast as that in America. We are very favoured in our much abused climate, but it has masked many faulty practices.

One of the most encouraging things in America today is the pioneering spirit still evident in so many individuals but now being applied to restoration for past mistakes. This attitude, of course, is not yet universal, but in every state we covered we passed fine conservation farms. Here are a few notes about some of the ones we visited. (These do not include the organic farms, although they are of course also conservation farms, for these I shall describe in Part III.)

Mr. Bradley, of Scottsville, Virginia, a photograph of whose house appeared in the July number, is doing a fine job. Incidentally he is a personal friend of Dr. Hugh Bennett, the father of conservation. On his farm he runs both cattle and sheep. This is unusual in this part of the States and can be done only if the flock is penned at night, because of the number of stray dogs. My photograph shows Mr. Bradley's son (our member) standing on a rock, protruding, as you can see, nearly two feet above the surface. There is more than one such rock in this field. Mr. Bradley told me that, up to and before the war, he used to plough this field over the top of the rock and did not even know of its existence. He left the farm on war work and, as happened elsewhere, intensive cropping was the wartime rule. When he returned, this had resulted in so much sheet erosion in this field that the rock appeared as you now see it in the photograph. This farm has now gone down very largely to grass in order to heal it, and very prosperous it looked, with all the livestock in fine fettle.

The first conservation farm we visited was Doughoregan Manor, near Baltimore in Maryland, belonging to our member, Mr. Philip Carroll. There were some unusual features here. In the first place, it was built in 1720 by Mr. Carroll's ancestors and his family has lived there continuously since, so he is one of the exceptions to the "exhausted farm and trek west" already described. His farm was the first to adopt conservation methods in the whole of Maryland, and a very fine job indeed he is doing, both in farming and forestry. He has a fine dairy herd, milked on the system known in England as the "milking parlour and covered yard", but in America by the rather attractive name of "loafing barn". This loafing barn idea is rather new in the States, but his version of it had what was a new feature to me. It had access to his silage pit, which, with the aid of a wooden grating gradually moved back, created a self-feeding device, so that the cattle helped themselves to the silage, a great labour-saving method. His milking parlour, too, was different from ours. The cows enter it sideways, so that the passage for the milkers to stand in is some two or three feet lower than the cow-standing. This enables the milking machines to be adjusted without stooping. I saw this method also in my recent visit to Norway, but I have never seen it in Britain.

One of the most interesting of the conservation farms we visited was in the Big Spring district of Texas. The owner is Mr. Davidson, to whom we had an A.C.W.W. introduction. The special interest here lies in the farm's striking contrast to the land all round it, which I must describe a little first. I learnt something of the history of these parts from Mr. Frazier, agricultural teacher at the Big Spring Junior College.

This country originally supported great herds of wild "buffalo" and, though always subject to periodical severe drought, was well watered by springs and creeks (the name Big Spring itself shows this). The staple diet of the Indian inhabitants was fish and shellfish and this, he said, was only 50 years ago. When first settled by American pioneers, the area became cattle ranching country, and supported one beast to the acre. In the early part of this century there was a very prolonged drought and this caused the first serious over-grazing, because there was no rail or road transport in those days and the cattle could not be moved out. The original herbage was eaten out, crown and all, and so destroyed. All the springs dried out and have never re-appeared. Thousands of cattle died. In time, the original herbage was replaced by desert plants, sage brush, mesquite, and a different kind of buffalo grass from the original. This is now known as the native herbage, but in reality all are invader plants. This new herbage could maintain

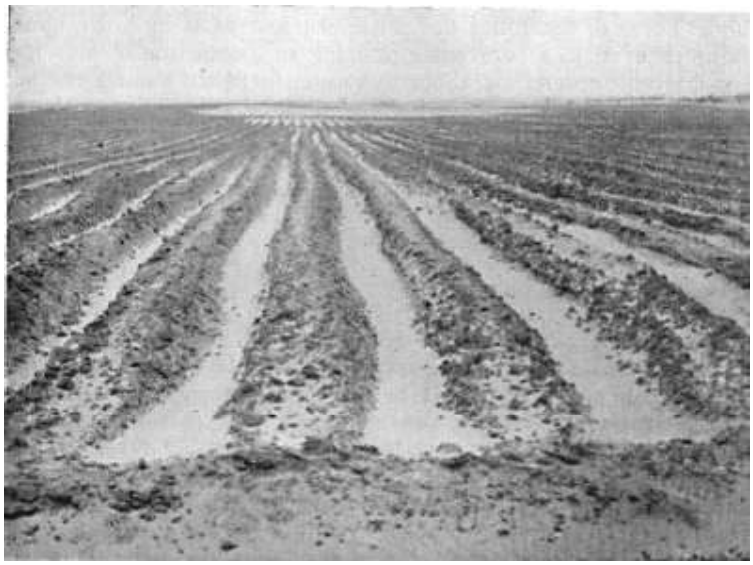
only one beast to 30 acres; but even though feed was so sparse, the soil is so rich in minerals, notably phosphate and calcium, that herds of the famous Texas Longhorns still throve, though drastically reduced in numbers. Mr. Frazier is at present doing some interesting research to discover wild plants that can be of use in helping to restore the soil.

Soil covered this rock before the war

A Dustbowl in the Making

At the present time, there is little open range country left, for during the last 20 years most of it has come under the plough and gone into cotton production. With the failure of cotton on the depleted soils further east, this is very profitable, even when a drought causes periodical total crop failure. The farmers say that if they can get a crop only every other year, it pays. The district is flat, very exposed and without windbreaks. Serious wind erosion is already taking place in this newly cultivated ground, and it seemed to me that these new cotton planters were inviting the same disasters that overtook their predecessors in the South. I was alarmed by the complacency of some of them. These are some of the remarks that were actually made to me, "This soil is so rich that you can go on growing cotton here indefinitely." "Oh, if it does blow, it doesn't matter. If my soil blows on to my neighbour's farm one day, it blows back on to mine the next." I even heard the old classic, "Oh, it will last my time". Having just come from the Deep South, I found it profoundly depressing to see the same story being re-enacted in the present day, for in these new cotton lands the remaining organic matter is being fast depleted. Soil structure is clearly breaking down, and sooner or later, if this monoculture cropping continues, depletion of the minerals must inevitably follow. The complacent planters blame everything on the climate (rainfall in 1951 was 12 inches, in 1952 it was 3 inches and at the time of my visit in March there had been no rain in 1953); and they might well have convinced me that conservation is not possible under their conditions, if I had not visited Mr. Davidson and also met Mr. Frazier and Dr. Keating of the local agricultural experiment station. One of the things the latter has done is to make a study of trees sufficiently drought-resisting to be suitable for windbreaks. Only the Arizona Cyprus and the red cedar have stood up to the test. The station encourages the planting of these; but it is hard going, as they have to be watered in the first year. It also encourages contour banking for wind-control and strip-cropping; but this too is hard going. Dr. Keating told me of some farmers who, after being successfully persuaded to put up contour ditches and banks, then proceeded to plough straight across them!

Why there is this resistence to techniques which would be in their own interests is difficult to understand, unless one local explanation that was given to me is correct, namely that these men are by instinct and tradition cattle ranchers and resent having had to become farmers. Both Mr. Frazier and Dr. Keating confirmed that conservation methods are possible, even in these conditions, and that the secret was very largely in the maintenance of organic matter.



Field prepared for cotton, showing ridges filled Kith blown soil. Near Big Spring, Texas

Then we went to visit the Davidson farm and could see for ourselves that this was true. Here was a farm that looked like a settled home. Some of the others had the appearance of being just a house dumped down in a bare waste, looking as though the owners had just arrived or were just about to vacate, for there was no attempt to make a garden or even grow a tree round some of these farmhouses. The colour surrounding the Davidsons' home was green. There were peach trees in blossom and other fruit trees nearby, and a good shelter belt of trees near the buildings; and I saw no evidence of wind erosion on his land.

This is his technique. He never has more than half the farm in cotton at any one time. The other half is either in Sudan grass, or partly in Sudan grass and partly in sorghum. Every winter he sows an autumn cover crop, usually wheat, but sometimes rye. This is the only time that a cereal will grow, as in summer the temperature is much too high. "If you have luck," he says, "you get just a little rain in September and then the cereal is fit to graze by January". Of the 3-inch rainfall in 1952, one half fell in September. Thus, when I saw the farm in the following March, the fields were looking healthy and green under wheat on which a fine herd of cattle were grazing. He keeps quite a big herd, and this year, he said, he had them all out by 1st January, since when they have been quite self-supporting without any supplementary feeding at all. This was particularly significant, since the two-year drought has resulted in the dispersal of the majority of the herds in the district. All that have been kept are the valuable breeding animals; and these have had to be fed almost without exception entirely on imported material.

Mr. Davidson admitted that it is only in about one year out of nine that he can turn out to graze so early, and that quite often there isn't enough to graze at all. This grazing is entirely dependent on an early autumn rain. However, in his view it still pays to sow the cover crop, because enough plant comes up without rain to hold the soil and stop blowing, and then this goes into preparation for one of the other crops.

I was more glad than I can say to have seen this farm and to know what can be done even under these very tough conditions.

While in Denver, Colorado, I was taken on a visit to Horticultural House. This is the centre of conservation activities in that district. I had an interesting talk therewith Dr. Kelly, one of the men in charge. Among his many duties, he advises and helps people generally to establish gardens in the very difficult and dry conditions pertaining to that district. He explained that there, at the foot of the Rocky Mountains, there is no mineral problem, because there is practically no rain. (the area depends for its moisture on melted snow); and because there is no rain, there has been no leaching of minerals. Their main problem is the need for organic matter, which he declared to be urgent, particularly because the soil is alkaline and depends so much on water to relieve the excessively alkaline conditions in the surface soil.

There is a flourishing Organic Gardening Club at Denver and Dr. Kelly, talking of this and other similar clubs said, "Of course, there are a number of cranks in them and they are very extreme and they do often overstate, but I can forgive them all their faults because of the good they are doing. Our need here for organic matter is so tremendous that anyone who is working on organic lines is worth supporting". I thought this an interesting and, from an orthodox scientist, an unusually wise and tolerant point of view. We had a most cordial meeting and agreed to exchange literature.

Stubble-Mulching in the Kansas Wheat Belt

The next conservation farmer we visited, once more on an A.C.W.W. introduction, was Mr. House, of Goodland, in northwest Kansas. This is in the heart of one of the great wheat belts and therefore different from anything we had hitherto seen. It is another dry area with a mineral-rich soil, in fact the local agricultural experiment station advises farmers that neither manure or fertilisers are required. This part of Kansas was once prairie, which was broken and put into continuous wheat growing during the great wheat boom. It is known as the High Plains, and, though not absolutely flat, is wide open to the wind with accompanying wind erosion hazard when cultivated; indeed, some of the classic dust-storms occurred here. But I was soon to get rid of my preconceived ideas

Wheat stubble, Goodland, Kansas

about it. The days of hundreds of square miles of monoculture wheat, sown year after year with the straw burnt and no livestock kept, are gone forever. After the famous "great blow" which resulted in the creation of the Conservation Service, the farmers, of this district at any rate, learnt their lesson. Conservation farming, which in this case means stubble-mulch farming, is now the rule; but in addition

all the best farmers, and Mr. House is certainly one of them, combine cattle raising with wheat growing. The new methods are extremely interesting. There is no subsoil water at all, and summer temperatures can reach 113°F. The limiting factor for growth is precipitation as rain or snow, but there is so little of that, that there is insufficient moisture in one year to provide the needs of a crop; so wheat is now grown only every other year, the technique being to conserve two years' moisture to grow one crop. Nowadays, when the crop is combined, the stubble is left nearly two feet high, the rest of the straw and chaff which comes from the combine being left scattered in this stubble. This traps any snow that falls and also prevents blowing. The bulk of it is left like this for a whole year and then, just before sowing the next crop in September, a Graham Plow, which is a kind of broad-bladed cultivator, is used. This cuts horizontally a few inches below the surface, leaving the stubble as a surface mulch into which the wheat is sown. By this method soil structure is retained and wheat yields doubled, that is to say that the yield of the bi-annual crop is twice that of the old annual crop.

Breeding stock on sorghum stalks

Automatic silage feeder

Mr. House farms 4,000 acres and runs 450 head of cattle. In any one year, about 2,000 acres is in wheat, 500 in cattle feed crops, and the balance of 1,500 acres in this so called "summer fallow", for which I feel a more appropriate name would be "conservation stubble". In those years when there has been sufficient autumn rain to give the young wheat a good early start, he grazes it from January to March. Additional grazing is sometimes provided by lightly discing a portion of the old stubble to promote germination of any wheat spilt from the combine,

but this plan works only in the years of adequate moisture. His 500 acres of feed crop consists partly of corn (maize) cut green for silage, and partly of sorghum and related crops. This latter portion is ripened, harvested with a binder, and stooked in the field (or "shocked", as they call it, using the Suffolk word). As there is no winter rain, it is left stooked all winter and carted to the fattening cattle as required. The breeding herd is usually wintered on a field of sorghum stalks.

We saw over 200 head of cattle being fattened in open yards. The feed troughs are filled by an ingenious automatic silage feeder (see photo). Mr. House uses no fertilizers. His stubble-mulch system, helped by his cattle dung, is maintaining the fertility of his farm with yields very considerably above the average for the district, which, according to the university records at Manhattan, is only 8½ bushels per acre.

The young wheat we saw growing in March, following a winter with very little snow, was nine inches high, a good thick plant and a rich dark green colour. It is sown wider apart than ours and in the shallow ridges left by the Graham Plow, so that any rain which falls goes to the roots. In addition, occasional contour banks had been made to check wind, and prevent run-off when the rare rains come. We did an extensive tour of the farm and nowhere did I see any signs of soil blowing; but this is due as much to Mr. House's skill as a farmer as to his methods. This dry wheat farming takes a very great deal of skill. The soil must never be touched except when it is moist. We saw part of another farm where there was a distinct tendency to blow, due, I was told, to the farmer having cultivated when the soil was too dry. If, at a roadside edge or on a headland, any soil starts blowing, Mr. House immediately "chisels" it. This is done with a special kind of cultivator which roughs it up again. That this works, shows to what an extent his soil structure is still intact.

Mr. and Mrs. House are quite young and are prosperous self-made farmers. They richly deserve their prosperity. They are also a delightful family and gave us wonderful hospitality while staying with them.

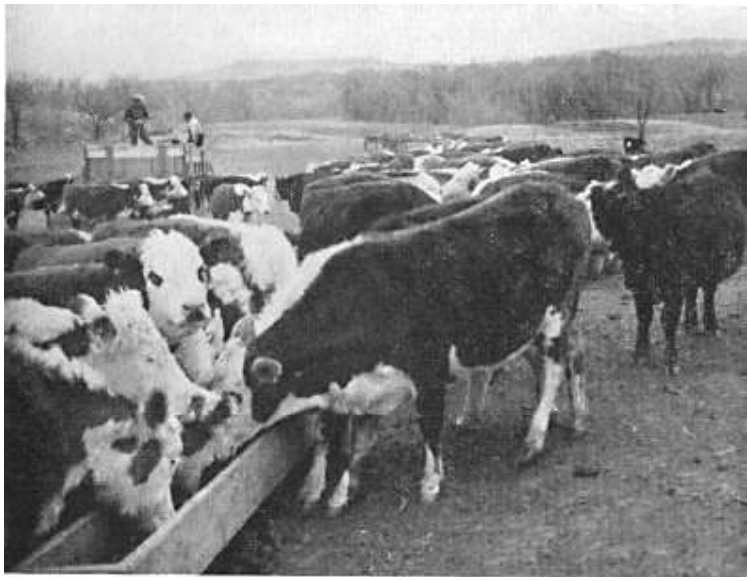
A Real Cattle Ranch

Before leaving Kansas, we had another great treat, for which again I have to thank A.C.W.W. This was a stay on a real cattle ranch belonging to Mr. Burdiss, near Manhattan. Unfortunately he was himself away, but his wife and daughters were wonderful hostesses. By real cattle ranch, I mean that the large herd was maintained entirely on native permanent pasture. It can truly be called a conservation ranch, for they are able to keep a cow to five acres and a yearling to four acres, an unusual achievement.

The ranch house is an old stone building, and this, too, is unusual. We got a real breath of the old days here and I wish I could have stayed longer. In the big ranch-house kitchen, where family and cowhands all eat together, there is a decorative frieze showing all the brands belonging to the different cattle herds throughout all the old cattle states. One of the cowhands knew a great deal of the history of these and told us some amusing stories about them. One particular brand, consisting of the figure 6 four times repeated, recalled the story of a cowboy who, in a game of poker, won the whole of his employer's ranch and cattle and everything else he possessed with a hand of four sixes. Hence this device was adopted as the new brand.

We got up very early the next morning, because I wanted to take photographs and see some of the cattle being fed. At this time of year supplementary feeding, in the form of very good silage and a certain amount of corn, is given to the in-calf heifers and the yearlings. The herd, as you can see from the photographs, are Here-fords, and I got a fine photograph of a bunch of eight or ten bulls, but space necessitated a choice between this and my photograph of the modern cowboy. I could not resist the latter!

The Modern Cowboy



In-calf heifers at the Burdiss ranch

There remains to tell, in this section, of our one experience of a real dust-storm. This occurred in northern New Mexico, and was unpleasant but instructive. The dust was so thick that we had to drive with our lights on and with extreme caution. The country was open prairie, but the interesting thing was that, every so often, the road crossed a section of the prairie that had clearly not been over-grazed. Here, no dust was blowing, except on the dried-up water-courses—water-courses which carry water only during the very occasional rains. The effect of this was extraordinary, because the twisting river-bed looked like a smoking snake, since this only was blowing. Alas! these areas did not last long; we soon passed once more into an over-grazed section with the blinding, cutting dust driving, through closed windows, into our clothes, our lungs and our eyes; getting even into shut suitcases.

Large Scale Composting

Since organic matter is the key to conservation, this section must contain some mention of the progress made in the composting of municipal wastes. The chief progress that has been made in the States since 1951, is, I think, in the attitude of mind. More and more communities are becoming aware of the need to change from waste disposal to waste utilisation. But all are waiting to see which of the pioneers first solves the technical problems, before putting the principle into practice. My own impression is that, between them, the pioneers have now solved most of the problems, if they would only pool their ideas; but so much money is involved in pioneering that I see little prospect of this being done. Each hopes to be able to provide all the answers single-handed.

Of Dr. Pfeiffer's contribution to this problem, I shall have something to say in Part 4. Here I shall describe only the three systems I myself visited. These did not include the Oakland plant on this trip, which in any case I understand is temporarily closed for expansion.

At Altoona, Pennsylvania, a private company is now composting the city garbage. In this locality, one of the worst technical problems, that of mechanised garbage separation, has been solved by making the householders do it. The city has for a long time had a bye-law under which all organic wastes in garbage have to be wrapped in paper and deposited separately from the ash and other refuse. This simplifies matters for the company, who have to deal only with these paper parcels of compostable material. These are tipped into an agromat, which is a container shaped like an inverted cone with a plate at the apex made of hard carbide (industrial diamond). This revolves at high speed and rapidly reduces the garbage to a sort of porridge. Its disadvantage is that a great deal of water has to be added, so that when it is emptied, the mush is far too wet to compost satisfactorily in that state. The problem of removing the excess water is now being studied.

Next we saw, at Dr. Earp Thomas's laboratories, the small prototype of his Continuous Flow Digester, now in use in more than one locality. In this, bacterial cultures are added to the material, which then passes in the Digester from one chamber to another. The chambers are kept at different temperatures to control the fermentation. One of the advantages of his invention seemed to me that it could be used in conjunction with other apparatus. Dr. Thomas claimed, for example, that it will handle the wet material that comes from an agromat. I have not seen one of these digesters in large-scale operation. Dr. Thomas has also invented a kind of small garden composter for converting the garbage of one household into compost. This also depends entirely on bacterial cultures, but is almost unbelievably simple. It consists of a kind of drum, looking rather like an oil drum, which has a special ventilation shaft for aeration and an opening at the bottom like the aperture for removing ash from a boiler. The householder puts his garbage in at the top, applies the culture, and then simply shovels out finished compost from the bottom. Once started, this process goes on all the time. I believe there are a great number in use, particularly by people with small city gardens, and therefore I must take his word for it that it works. I would very much like to have seen one in operation.

Progress at the Chicago Stockyards

Lastly, I revisited the plant at the Chicago Stockyards. Here, tremendous strides have been made since I saw it in 1951. It is now a thoroughly sound engineering job and, though designed to deal with manure and waste hay and litter from the square mile of cattle pens, a trial with garbage has been made with complete success. The stockyard material goes through an initial shrinking period, that is to say decomposition starts in heaps in the open, where a converted coal-mining cutter with sweeping steel arms makes a wonderful job of disintegrating and turning it, or passing it on to an elevator. After this initial shrinking, a rapid aerobic fermentation takes place in silos. In 1951, the system for this was to blow air through the material in the silo, and it never worked satisfactorily. Now, as the

material slowly but continuously drops down inside the silo, from the top to the bottom, and is then carried to the top again, a current of warm air is passed over it in such a way that the whole of it is properly aerated. The control of moisture and air is very skilfully managed and is under strict control. Tests are made at least every hour. A simple but ingenious biological test has also been devised to determine when the decomposition process is completed. The average time taken in the silos is three days. At present the compost is handled in batches, but soon three silos will work in unison in such a manner that, from the bottom of one, the material will be passed to the top of the next. It will then be possible to have a continuous flow of raw material entering at one end and finished compost coming out at the other. With the new machinery and method, no mechanical crushing is now required and nothing is being added to the material, yet it comes out with a surprisingly high analysis. The final product is sieved and the coarser particles are returned to the silos. This is the only activator used. The compost is air-dried at the finish, but not at a high temperature, so that the actinomycete fungus is not killed. Thus the finished compost retains the pleasant, earthy smell of home-made compost. The final product has a very fine texture and contains from 17% to 25% moisture. This is dry enough to handle easily and bag up for transport. It is sold at rather a high price at present, but the demand exceeds the supply.

The capital outlay for this type of plant must be high, but the economics of it, now that it is improved, are working out satisfactorily. I think there is a great future for this plant.

These are, of course, by no means the only large-scale municipal composting ventures in America, but they are the only ones we were able to visit personally on this trip. It is a sign of the times that a professor at one of the northern universities has been commissioned to compile a list of all the municipal composting plants throughout the world and write a report on their methods.

PART III

Organic Farms and Gardens

(With Special Reference to Natural Biological Pest Control)

Before making my report on the organic farms and gardens that I and Miss Carnley visited during our American tour, I want to give a warning, particularly to organic enthusiasts, which I believe to be both necessary and timely. It is to point to the danger of confusing principle with technique. It is a surprisingly easy error to fall into, but only travel, involving visits to a wide variety of climates and conditions, has brought this home to me.

A principle, if true, has universal application, but implementing that principle may require many totally different techniques. As I see it, the principle behind all so-called organic theories is quite simple. It is that life is important to life and that one kind of life is dependent directly, or indirectly, on most other kinds of life. Thus the aim of the organic farmer or gardener is to do only that which will foster life throughout the whole nutrition cycle.

In pursuit of this aim his first concern is to foster life in the soil itself. The requirements of soil life are identical with those of all other forms of life, namely (1) sufficient fresh, raw (i.e. living) food in variety, (2) sufficient air, (3) sufficient shelter, (4) sufficient water (but not too much or it will exclude air), (5) sufficient mineral elements of all the necessary kinds, major and minor, in balance.

Given these five essentials, soil life can be counted on to provide a sound nutrition for the crops growing in that soil and the animals and humans feeding on those crops. But the techniques for insuring these essentials must vary as the circumstances vary. The first of them, living food, can be supplied by farmyard manure, by temporary pastures (leys), by green manuring, by compost, by mulching, or by a combination of some or all of these. Aeration can be secured by a judicious combination of suitable cultivations, subsoiling, the use of deep-rooting plants, earthworm activity and, in some cases, drainage. Shelter means soil-cover. It can be given by crop, cover-crop, grass, weeds, or mulch. Which of any of the above is the right one depends on local conditions. Water is less easy to control. It may come as rainfall or snow, from underground reserves, or from irrigation. Fundamentally, the water supply of a given area depends on afforestation on the watersheds and conservation lower down, but, even in this, techniques are governed by circumstances and must not be confused with the principle. For example, in England it is axiomatic that conifers are poor water regulators and that it is the hardwood trees that produce the type of sponge-like forest humus which allows absorption of water, so that it may seep into1 the underground reservoirs and not run off the surface to cause erosion or floods. I did not realise that this had become almost a principle in my mind until I discovered that, in sections of the United States' Eastern seaboard, the reverse is the case. I found this a very salutary lesson.

The reason for the difference is that in those parts the principal winter precipitation is in the form of snow. The broad leaves of the deciduous trees remain like flat shingles under the snow, and when it melts the water rushes off them to the valley below. Conifers, on the other hand, because they are evergreen, hold much of the snow in their branches and, when the thaw comes, the water can drip and seep through the much more porous pine needles and so go down instead of off.

Last on my list of essentials are the minerals. These come from the rock formation underlying soil and subsoil and, to a lesser degree, from the air through cosmic and industrial dust. Many soils are derived from certain types of primary or sedimentary rock formations or glacial deposits which contain all the known mineral requirements for the higher life forms. In such cases the reserves are virtually unlimited and the problem of the organic farmer is confined to

mobilising them, i.e. making them available. This the life in the soil will apparently do indefinitely, if assisted by good mixed farming practices, including a return to the soil of all the plant and animal residues that came from it. But while all soils, no matter from what rock derived, will, given water, grow some kind of vegetation, by no means all rock formations contain the array of minerals needed to grow food crops or to nourish animal bodies. In such cases fertility cannot adequately be maintained merely by returning to the soil the residues of produce that derives from it. Where essential minerals are fundamentally lacking, the techniques for applying the principle of fostering life in the soil must include importing them. This the organic farmer does not normally do by using soluble commercial fertilizers, because he believes in feeding his crops only through the agency of the soil life. He will not risk short-circuiting this part of the nutrition chain, for experience has led him to believe that to do so may lead to conditions requiring poison sprays. He therefore chooses one of many alternative methods. He may use crushed rock dusts from natural mineral deposits elsewhere (such as ground limestone, crushed phosphate rock, greensand, etc.); he may use seaweed, raw or dried, direct on the soil or through his livestock; or he may use municipal compost made from plant or animal residues that have been nurtured on soils that are not deficient.

Depleted soils are so common in America that the addition of rock dusts to compost heaps is the rule rather than the exception, and the definition in the States of organically grown food is "food grown with organic matter plus natural minerals, but without the use of manufactured, synthetic, commercial fertilizers or poison sprays".

It would save much confusion if we all adopted the name biological farming rather than organic farming. We should then keep the emphasis where it belongs, on the fostering of life and on biological balance, and not on just one of the techniques for achieving this, which, if narrowly interpreted, may be effective only in a certain set of circumstances.

However, for this report, I shall stick to the old name. Organic Gardens Need No "Protection"

As usual, the thing which struck me most in all the organic farms and gardens we visited, was the fact that no form of pesticide was used, or needed. This is more impressive in America than in some other places, because poison spraying is so nearly universal in the States that the average cultivator simply cannot believe that any crop can be grown without such "protection".

The first example we met was in a small private garden in Atlanta, Georgia (where there is an active Organic Gardening Club). It belonged to our members, Dr. and Mrs. Williamson (who were also our hosts and who organised a very successful meeting). They are compost gardeners and, among many other kindnesses, they presented us with a large bag of pecan nuts from their own compost-grown trees. We are still eating these nuts (in December). They have kept perfectly and so far not one has been unsound. Pecans are an important commercial crop in Georgia, but we were told that they were becoming so diseased that "the crop was moving South".

Later, in our route across the state, we drove past so many pecan orchards that we wondered if the report was exaggerated, until we passed one with a large noticeboard by the roadside reading— believe it or not OUR nuts are still sound. This orchard was grassed down and cattle were grazing among the trees, which were all heavily mulched. By contrast, the great majority of the orchards we passed were under bare cultivation. In the few exceptions where cover-cropping and cattle were present, the trees certainly looked much more vigorous.

The Williamsons' freedom from pests and disease was not confined to their nut trees, but extended to all their crops. They told me of an amusing story of a neighbour who came over to visit them one day who, looking at their crops, said, "Why haven't you got any bugs on your beans? I spray my beans every day and they are full of bugs!" Dr. Williamson answered by stooping to pick up a handful of compost from the surface of his bean bed and said, "This is the reason. This is

my fertilizer and my spray." "But I don't think he understood what I was talking about," he added to me.

Houston, Texas, is another city with a nourishing Organic Gardening Club. Its members sponsored my meeting there and one of them, Mrs. Thibodeaux (now a Soil Association member), was our hostess for the second night of our stay. She has a splendid organic garden in which everything was the picture of health. Her pride and joy were her globe artichokes, said to be impossible to grow in that soil and climate. One very charming feature of her garden was the use of strawberries as the edging plants between the flower borders and the lawns, so that in the season, no matter where she might happen to be working in the garden, she could refresh herself with ripe fruit. I asked about birds. She said there was enough fruit for everyone, including the birds, and small boys who took a short cut through her garden on their way to and from school.

Pecan orchard in Georgia, undersown to cattle pasture

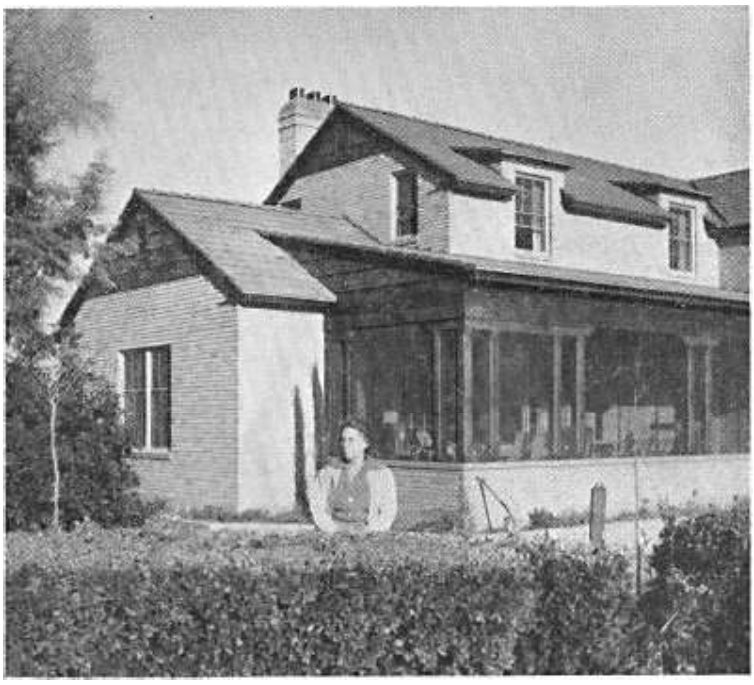
It was at Houston that I met Dr. Nichols, whose family history I recounted in my last instalment. He had just been made first president of the new group called Natural Food Associates Inc., whose journal Natural Living is edited by our member Alden Stahr and is successor to that excellent little leaflet Normal Agriculture. Dr. Nichols is a surgeon and he and his partner (a physician) have their own thirty-five bed hospital in North-Eastern Texas, where Dr. Nichols also owns a farm, which, according to him, is the poorest sandy soil in the whole of Texas and was quite worn out when he bought it. He is successfully bringing it back to life and fertility through organic methods and plans to use the organically-grown food he raises as part of his therapy at his hospital. His experience to date leads him to believe that, in due course, he will be in a position to produce reports which will startle the medical world. On the purely farming side, his first success was with a peach orchard in which the trees were so old and diseased that they had long since ceased to bear and were, in fact, half dead. He was advised to grub them all up, but he fed them organically instead, and this year they are bearing again.

Globe artichokes in Mrs. Thibodeaux's organic garden, Houston, Texas

After our visit to Big Spring, described in my last instalment, we continued west to El Paso, another cotton-growing district in the state of Texas, but quite different, because it is in the Rio Grande irrigation area. We were due to stay, on an A.C.W.W. introduction, with Mrs. Ezell, the wife of a cotton farmer and herself born and reared on a cattle ranch. In a charming letter of welcome before our arrival she gave me the following interesting historical notes about her part of Texas:

"Let me tell you something of our valley. Just a long, narrow strip of fertile soil, responding beautifully to irrigation. Like all over, we are scarce of water. Snow in the mountains becomes less each year, or is dissipated by wind before melting into water for a run off. Our country dates back to Spanish acquisition of Mexico. As the army and priests moved north, seeking mythical gold and jewel mines, they established Missions at each likely stop, building forts and churches by slave labour, using captured Indians. On reaching the Rio Grande, which was dry except during the run-off from melting snow, they found the mountains impassable except for a narrow trail. For generations this pass, narrow though it was, was the only way out towards the North or West, so it was called "El Paso del Norte", from which El Paso has its name.

"From Chichuaha, two hundred miles south, to Albuquerque two hundred miles north, the desert provided no water, all drinking water had to be carried in raw hide bags on the backs of slave Indians. Of course many died of thirst and other troubles, so our "Camino Real" was known as the "Camino del Muerto" or road of death. The irony of it all was, they had only to dig a few feet into the sands for abundant water. The Indians knew this but were not telling.



Mrs. Ezell, of El Paso, Texas, and the Ezell farmhouse

Turning and shredding compost on the Ezell cotton farm, El Paso, Texas

"Because of this invasion, many towns and cities have Spanish names."

This letter made it certain we were in for an interesting visit, but I did not realise how interesting until we got there.

We found that both the Ezells and their next-door neighbour, Mr. Gillett, were enthusiastic organic farmers. Both were making large quantities of compost. Mr. Ezell obtains the bulk of his material from a neighbouring stock market. He had a huge pile, when we were there, of many hundred tons, which we saw being turned, and put through a shredder in the process. The finely pulverised compost is then mechanically loaded into trailers, by a tractor with front hydraulic loading attachment, and taken to the fields where it is applied by an ordinary fertilizer distributor immediately before ridging for cotton. A second application is made before planting. Mr. Gillett's technique is different. He keeps a herd of cattle to provide the animal element and he puts the finished compost into his main irrigation channel and floods it over the land. Both methods appear equally successful.

Mr. Gillett told us that he had farmed his present farm for forty years and that in the early days he got tremendous crops—"alfalfa waist high". Then the land began to go back. "I could see the creeping paralysis coming", he said, "and I decided to make a complete change-over and stop farming for dollars and start farming for farming." (Or, as we would put it, he stopped mining and started farming.) For the last five years he has used no commercial fertilizers, simply compost to which natural crushed rock minerals are added. The land has come back; it is once more full of earthworms (which had previously disappeared) and yields of cotton and other crops are steadily rising.

Mr. Ezell's experience is the same, and for the last three years neither have had to do any spraying at all. Probably only my American readers will appreciate the full significance of this, because throughout all United States cotton-growing districts, the ravages of the cotton boll weevil are getting more and more serious each year and spraying has become universal.

Neither Mr. Ezell nor Mr. Gillett had heard of the Soil Association before our visit. Both became members forthwith.

Compost heap beside irrigation channel on the Gillett cotton farm, El Paso, Texas

Before leaving the subject of cotton, I must repeat a story I heard, of a Texan cotton-grower who made the discovery that if he turned geese into his cotton fields they ate the weeds but did not touch the young cotton plants. So, instead of spending the usual large sums on labour for hoeing (this is one of the major items of expenditure in cotton growing), he turned geese into the plantations. The result was that not only were labour costs drastically cut, but none of the erosion occurred that so frequently follows loosening the soil with the hoe. In addition, the geese manured the fields, consumed all the weeds, and fattened in the process. So the farmer had two crops (cotton and fat geese) instead of one. I hope other cotton-growers will explore the possibilities of this seemingly admirable plan.

The next organically-grown commercial crops we saw were two avocado-pear groves in the Palomar Valley conservation area of southern California. The first belongs to Mr. H. W. Bradley, who joined the Association on the occasion of our visit. Soil cover is the keynote of his methods, the groves are undersown, the grass being continually cut and dropped. Each tree is heavily mulched, largely with its own leaves (which in many groves are collected and burnt), and all banks are protected by creeping mesembryanthemum. All pathways are covered with a thick straw mulch to prevent any run off erosion, and he keeps his own bees for pollination. The trees looked extremely healthy and for sometime now no spraying has been necessary. Production has risen in the four years since he

adopted these methods from 500 boxes for a given number of trees to 2,000 and is still rising.

The other grove is owned by a Mr. Antony and was of special interest. To begin with, it is the oldest commercial avocado-pear grove in the United States; and Mr. Antony, so our guide, the Conservation Officer, told us, has managed it by organic methods from the start and has never had to spray. He is now a widower, and he and his sister (both elderly people) came out to greet us when we called to ask permission to see the grove. In five minutes' conversation, it became clear that their enthusiasm for organic methods derived from a deep-seated belief in wholeness and a very clear grasp of its implications. They were grand people. Our guide then drove us round the grove. Contour dykes, heavy mulching and compost were all in evidence, also conservation check-dams in some of the fields below the grove. Dams of this kind are not intended to store water, but to check it so that it runs into and not off the land. One of the nicest features of Mr. Antony's grove was his method of ground vermin control. Gophers and other rodents are often very troublesome in these orchards. Most people both poison and trap. Mr. Antony does neither, he merely provides housing accommodation for owls. In every acre or so of his grove there is a neat and attractive little wooden cot on a 15-foot pole. These houses are well thought of by the owls who make their home and breed in his grove and look after all vermin control in return. When I took the photograph of one of these owl houses, the inhabitant was at home. I saw his face looking out of his entrance hole as we drove up, but he ducked down out of sight when I got out of the car to take the snap. I thought this idea of Mr. Antony's a beautiful example of biological pest control through intelligent co-operation with Nature.

One of the most interesting examples anywhere of the operation of the nutrition cycle, and biological balance, occurred at Mr. Barton's school in the mountains at Topanga, California. He and Mrs. Barton are old members of the Soil Association and were my hosts in 1951, as well as on my second visit in 1953. Some account of his experience appeared in the October, 1951, issue of Mother Earth, but it will bear repetition and this time I can give the story in his own words, as spoken in a recorded interview with me on my tape machine.

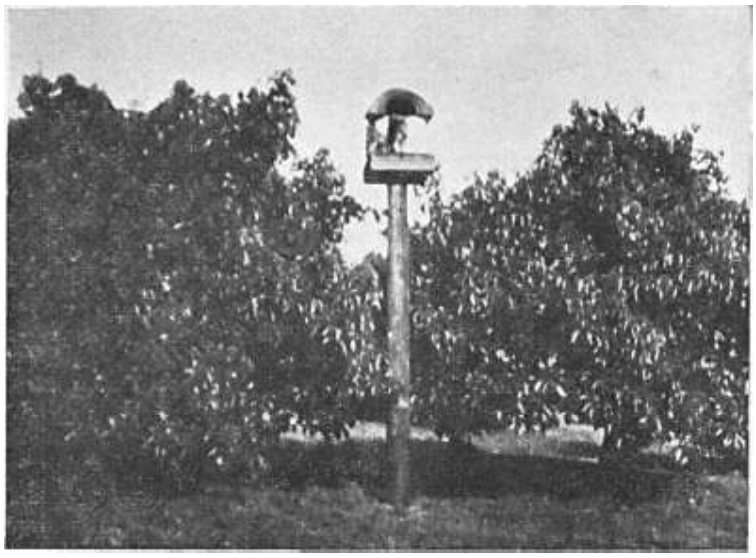
Mr. Barton : "When we first came here, 22 years ago, there were about 15 acres of arable land here, and about 80 acres of pasture, some renewed and some rough, that we could avail ourselves of to grow crops in. The soil here, as a rule, is quite heavy and crops are grown mostly by 'dry farming'. The ground is kept cultivated during the rainy season, then the accumulated water is kept in by earth mulch and the crops grow very successfully.

"Soon after we moved here, two little ailing sons of a professor at one of the universities were sent here to live. We had no knowledge beyond the most ordinary of nutritional affairs, but my background had been that of more or less old-time agriculture and we set about to adapt ourselves to the environment as we found it. We began to grow a diversity of crops, chiefly through my own interest in that. More children were sent to our place and a school grew up here, and we set about in earnest to grow crops, all directed to our cellar, and to our kitchen and the feeding of our little community, which finally came to number about 70 people. During this time we did vegetable gardening here, because we had two fine, big springs. In trying to loosen up this heavy, dark, clay soil, called 'adobe' soil, we went out in the woods and collected large amounts of leaf mould. We gathered up old piles of straw and manure that had been thrown out—anything of that sort to work into the soil. We also, to save moisture, piled that sort of thing round our fruit trees whenever we could get it. We had no other idea than the narrow one of mechanical improvements and the water-retaining advantages which came from this mulching. However, after a while, I became aware of the fact that a lot of people, living right here in this mountain area, always had trouble is raising both fruit trees and row-crops due to infestation by different kinds of borers and scale, aphis and other pests.

Black Dots = Stops. Capital Letters = Host organisation and/or organisation sponsoring meeting. When there are two, it means one was host and the other sponsored the meeting. S == Soil Association Member. W = A.C.W.W. member. A = Altrusan. L = Luncheon. H = Hotel, i.e. the only nights when we did not have private hospitality. F = Personal friend or friend of a Soil Association member. 0 = Organic Gardening Club or other organisation or individual not Soil Association members at that time. (Silhouette of British Isles is drawn to the same scale and superimposed for comparison).

Black Dots not connected by black line were visits by other means of transport than our station wagon; i.e. to Mr. Raney at Fort Lauderdale, S. Florida, by air; to Professor W. S. Monk at Minneapolis, Minnesota, by train; and the whole series in New England organised by Mr. John Pearmain and driven by Mrs. Mary Pierce in her car.

S with ring round = Start and Finish. Following the line from this point in a clockwise direction, the stopping places were as follows : Lancaster, Pa.; Kennett Square, Pa.; Ellicot City, Maryland; Washington, D.C. (two hours only); Scottsville, Va.; Richmond, Va.; Mocksville, N. Carolina; Winston Salem, N.C. (lunch); Greensboro, N.C.; Tryon, N.C.; Atlanta, Georgia; Jacksonville, Florida; Gainesville, Fla. (afternoon only); Crestview, Fla.; Mobile, Alabama (lunch); New Orleans, Louisiana; Houston, Texas; Dallas, Texas; Oklahoma City, Okla.; Wichita Falls, Texas; Big Spring, Texas; El Paso, Texas; Tucson, Arizona; Phoenix, Arizona; San Diego, Calif.; Topanga, Calif, and Redlands, Calif.; Needles, Arizona; Winslow, Arizona (after seeing Grand Canyon); Albuquerque, New Mexico; Santa Fe, N.Mexico; Trinidad, Colorado; Denver, Colorado; Goodland, Kansas; Manhattan, Kansas; Columbia, Missouri; Burlington, Iowa; Walker, Iowa and Iowa City; Woodstock, Illinois; Chicago; McNabb, Ill.; Marion, Indiana; Worthington, Ohio (also "Friends of the Land" Meeting at Columbus, Ohio); Oberlin, Ohio; Pittsburg, Pa.; Altoona, Pa.



Owl house in Mr. Anthony's organic avocardo-pear orchard

"When we came here, our apple trees, too, were infested with woolly aphis and there was a large amount of wormy apples dropped every year. We also had aphis in garden plants that we put in, and there was a bad infestation of scale on some of the other plants, too. As time went on, all these things completely disappeared. Whether that was due to the fact that we didn't spray or dust or fumigate at any time during our stay on the place and so allowed the natural enemies to function as they should, I don't know; but whatever the cause was, I know that a good deal of this unconscious soil improvement had gone on all the time. About 1936 we heard about the work of Sir Albert Howard and I read his book with great interest and we took advantage of the excellent sources of compostable materials here in the hills."

E.B.B.: "Isn't it true that you provided an isolation, sanatorium building for sick children and never had to use it?"

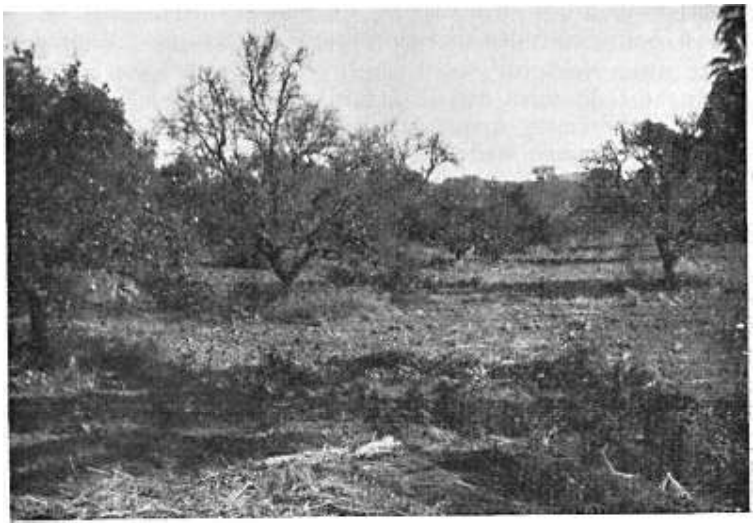
Mr. Barton: "Oh, yes. There was the building you saw this morning and asked about. That was set aside as an isolation ward, as it were, for children who had sniffles and colds and so on and, as a matter of fact, in the first years that was used to a certain extent, but those things rapidly became so rare—in fact, in one year this school went through an entire year without a single cold. There was only one year we did that, but the necessity for using this sort of hospital became so very rare that we ceased to use it for that and it was turned into a laundry.

"In regard to the lines of investigation of human health through healthy plants and healthy soil, it was in the middle of the forties, round '45 or '46, that dentists and family doctors and others in the nearby cities began to find tooth conditions, jaw structure and bones and general conditions of fundamental health so good among children who had been sent up here to our little school. They were very interested in this. I remember doctors coming up and wanting X-ray photographs; others would come up with instruments and there was general investigation and interest.

"It was only then, after some fifteen years of operation, that we discovered that these improvements in the children's health, the soundness, and the freedom from disease and pest conditions of our livestock, our trees and crops in general, was put down to good soil conditions. We had not known this before and, in reading later of the investigations and what the investigations have shown—namely, that there is such a thing as a sick soil and a healthy soil, and that these final results were due to the healthy state of our soil here—it struck me that the results on our place, and what they might prove, are the more convincing because

they were first come upon when there was no proof, and no one was looking for a theory to be confirmed. We saw the results before we had a theory, which would guarantee us not having fooled ourselves into finding results in our anxiety to see some theory confirmed."

Before leaving California, we paid a short visit to our member, Mr. Wesley Champion, of Champion Brothers, the organic orange growers at Redlands. I first saw this grove in 1951 when Mr. Barton drove me over, and, for the sake of members who have joined since that date, I reprint here what I wrote about it on that occasion.



Southern Californian orange grove in dying condition, typical of many (Photographed in 1951)

Champion Bros, all-organic orange grove, photographed same day and in same district as grove shown above

"All day we had been driving through orange groves—70 miles of them. Few looked really healthy and alarmingly many were clearly going back rapidly, with a high proportion of dead or dying trees. I had already heard that the Champion grove had been in a like state a few years ago but had been restored to health by organic treatment. I was therefore eager to get the contrasting photographs reproduced opposite. As we passed these diseased groves, therefore, I kept saying 'Stop, let me photograph that one' to which Mr. Barton invariably

replied 'There's lots of time, we'll pass plenty worse than that, from which you can gather the extent to which the Californian orange industry is threatened. I was told that in the ordinary commercial groves there is little or no conservation of organic matter. The trees are fed only with artificial fertilizers and are heavily sprayed. Most groves, in fact, carry large red notices, warning that it is dangerous to enter, because they have been sprayed, and small dead birds can frequently be seen. The oranges are harvested before they are ripe and are then dipped in disinfectant, dyed to make them look ripe, and then waxed!

"The contrast at Champion Bros. was almost unbelievable. In three years, following a system of heavy mulching plus compost making, for which they keep a few fattening steers, the grove has been restored to health. The fruit is sun-ripened on the tree and no poison sprays are used. The flavour is superb, and one can even eat the skin, which is not bitter. I brought a lot home with me, and they kept perfectly, the last being eaten two months later at the Royal Show in July."

By 1953, many of the unhealthy groves I had seen in 1951 had been grubbed up and the land sold for building. Mr. Champion's grove, however, was as flourishing as ever. He has added the cutting and dropping of an undersown crop and occasional subsoiling to his other techniques, and has erected a series of mechanical wind machines for frost protection. He was as generous as before in gifts of fruit, and the flavour and keeping quality were as good as ever. He has been forced to cater for the public demand for "eye appeal" to the extent of installing a machine with soft, revolving brushes to wipe off the natural bloom of sun-ripened oranges (rather like the bloom on grapes). This leaves them as polished looking as the waxed fruit to which the public has become accustomed. Since all bloom on fruit is a protective enzyme, this seems to me a pity; but in actual fact, the fruit so treated that I brought home with me kept as well as before, though I think it bruises more easily.

I heard of one other interesting organic enterprise in that part of California, but was not able to visit it. This was a very large farm for the production of Nutrilite, a natural vitamin product for human consumption made from alfalfa. When in Houston, I had been shown a lot of coloured slides of the growing process. Each time the crop is cut, the machine is first set to harvest just the top few inches. Only this growing tip goes to the drying plant for manufacture into Nutrilite. The rest of the crop is then cut to ground level and composted with cattle manure and natural rock minerals. The composting is entirely mechanised, with a very original and extremely efficient machine. The finished compost is returned to the alfalfa field to feed the next cut. The fields are grazed from time to time.

Later, when in Kansas City, I was given some interesting scientific information about another organically-grown vitamin product made from cereal grasses. Some reference will be made to this in Part IV of my report.

Organic Methods Under Dry Conditions

After leaving California, we once more crossed the state of Arizona (taking a day off to visit the Grand Canyon), and thence on to Albuquerque in New Mexico, where we arrived in the dust storm I described in my last instalment. Our hostess was Mrs. Pettitt, who had booked me to speak to a group of Garden Clubs. She herself is a very keen organic gardener (and now a Soil Association member). It was thrilling to see, in those terribly dry conditions, the same successful results that one has come to expect of organic methods elsewhere—pest control without sprays, and healthy plants where neighbouring gardeners, using conventional methods, failed.

Mrs. Pettitt told me of one recent experience which was an excellent demonstration of the way biological balance works in practice. The Arbor Vitae is a very popular ornamental shrub in Albuquerque gardens. These were suffering at the time of our visit from a very severe infestation of an insect pest of the aphis type. The attack was so bad that the local horticultural adviser declared that before long there would not be a single specimen of this shrub in the whole of

Albuquerque, and this despite continual effort to destroy the pest with sprays. One day Mrs. Pettitt found one of her trees to be heavily infested, and she thought to herself "Here is the first case in which my organic gardening has failed." But she was very busy and occupied and was unable to look at the tree again until quite late in the following day, when she found it entirely covered with ladybirds. So she left them and again forgot about it. A week or so later, when she suddenly thought of the tree and went out to look, both pests and ladybirds had disappeared and the tree was entirely undamaged.

We now take a long hop into Iowa. There is more to tell of the intervening visits, but this belongs to Part IV.

Iowa is known as the corn (maize) state. It is also famous for its pigs. The Treichler family of Walker, near Cedar Rapids, were our hosts. They are what are called "Homesteaders", they run a family farm on a self-supporting basis without paid labour. William Treichler junior is about our oldest United States member. I had a wonderful time on this farm in 1951 and it was grand on this second visit to see a third generation coming along, the youngsters as full of vitality and cheerfulness as could possibly be—a grand testimonial to nurture on fresh, whole, organically-raised food.

During our stay, we were taken to visit one of the most interesting farms of our whole trip. The owner, Mr. Burt Neal, is an old man now—but what a personality! And how wise! He could teach many so-called experts a thing or two. He inherited his 240-acre farm from his father, who was one of the early pioneers. Mr. Neal, himself, can remember when most of the Iowa country was forest land. He has watched, first the disappearance of the trees, then the going-back of many of the once fertile farms which followed. These once grew good wheat, but disease and pests have banished it (the Treichlers are among the few farmers in the district who can still grow wheat, see Mother Earth, October, 1951). Corn (maize) took the place of wheat, but in time yields began to fall and hybrid corn was introduced to bolster them up again, but at the sacrifice of protein content. Now yields even of hybrid corn are falling. Average yields of the old, open-pollinated corn used to be over 100 bushels per acre with a protein content of around 10 per cent. Present average yields of the hybrid corn are only 80 bushels per acre and the protein content has fallen to 6%.

In-Breeding Without Loss of Vigour

Mr. Neal has adopted none of the modern inovations. He has gone right on farming the land organically, as his father did before him. Not only has he resisted all pressure to persuade him to grow hybrid corn, but he is still using only his own selected seed from the stock of open-pollinated corn originally purchased in 1903. His average yields are 125 bushels to the acre with a protein content of 11%. His livestock achievement is equally interesting. He has a self-contained beef Shorthorn herd of 80 head into which no fresh blood, either male or female, has been introduced since 1912! All cattle are fed exclusively from the produce of the farm, grass in summer, hay, silage and corn in winter. There is no evidence, despite the close in-breeding, of any loss of vigour, health or size. The secret of his success, I believe, lies in his method of culling. This has always been for stamina. From the start, any animal which failed to adapt itself perfectly to its environment was culled. His demand is for heifers who will breed regularly, and fatten their calves and themselves on his own fodder without concentrates. Those that fell short of this standard were the ones chosen for culling. He has also selected on the basis of those producing the best quality in the most expensive cuts of meat. The result is a herd unsurpassed in uniformity and vigour. His farm is divided into 160 acres of arable tillage and 80 of permanent pasture. He operates a three-year rotation on his arable land—(1) corn (maize), (2) oats undersown with grass and clover, (3) hay, silage and grazing.

Except for ground limestone and, on one occasion only, a little rock phosphate, he has used nothing in all these years but his farmyard manure. Quite recently, however, he has introduced poultry and had about 1,000 head when we

visited him. I am proud to say that he, too, is now a member of the Soil Association.

Farmers' Mounting Fertilizer Bills

At a conservation meeting that I attended in Iowa City later the same week, a professor of the state college and experiment station of Ames was one of the speakers. He said that since the War the average use of commercial fertilizers in Iowa had risen from 1 lb. per acre to 40 lbs. per acre "which was at the moment maintaining the level of fertility, but it was expected that by 1965 six to ten times as much was going to be used." In conversation with farmers, I had already heard much grumbling that they could not afford the cost of even the present fertilizer bill and that they have to use more every year to get the same results. They are beginning to be impatient with college advice and are ripe to listen to what such men as Burt Neal can teach them.

Apropos of this, Mr. Treichler senior expressed an unusual view concerning agricultural experiment stations. He said that in the long run they tend to follow rather than to lead. They give certain advice, which is largely followed, but there are always some individuals, like Mr. Neal, who pay no attention and go their own way. Sooner or later, the neighbours see that they have been on the wrong track and they then copy the successful neighbour, who is obviously doing the right thing. Then the experiment stations follow that lead. What a reflection on scientific training—if true!

Continuing our journey, the next two organic farms we stayed at were in the state of Illinois. The first belonged to Mr. Hamilton Noyes, another new member, who organised the meeting at Woodstock. One admirable feature of Mr. Noyes' farm was his excellent conservation of liquid manure and his happy use of a converted poison spray machine to distribute the manure over his leys, or to spray it onto his compost heaps. The machine has its own pump which, according to setting, can be used both to fill its own tank with liquid manure from the main underground storage tank, and to pump the liquid through the spray nozzles. We met some very interesting people at Mr. Noyes' house about whom I shall be writing in Part IV.

The second Illinois farm belongs to our member, Mr. E. M. Halbleib of McNabb, and there were many interesting features there. In the first place, it was the only big meeting I addressed that assembled actually on a farm. The building with the big double doors in the middle of my photograph housed the meeting. A sliding door from this opened into the big building on the left, which is the cow byre. Mr. Halbleib's daughter took a delightful photograph of the packed audience with the cowstalls showing in the background. I borrowed the negative, but unfortunately, the definition was not quite good enough for reproduction. Busloads came from five states to this meeting, as well as a large number of the local farming community. The Halbleibs have a big retail business in organically-grown produce, including homeground wholewheat flour, and the whole atmosphere of the place was extremely inspiring. Like Burt Neal, Mr. Halbleib inherited the farm from his father and he, too, is still growing only open-pollinated corn and is averaging 100 bushels to the acre with a protein content of 12%, thus proving that Mr. Neal's experience is no isolated exception to the rule.

As can be seen from the photograph, the farm is called the Halbleib Orchards and, though actually a mixed farm with a good dairy herd, apples and other fruit are still an important crop. I asked Mr. Halbleib whether his results with apples were as successful as with his other crops, because everywhere commercial apple-growing seems to be the most difficult enterprise to pursue profitably without spraying. Mr. Halbleib confessed that he, too, found this crop difficult. While he does not do any spraying, and said that at one end of his orchard, which was on gravelly soil, there was no trouble, he admitted some trouble with pests at the other end, despite compost top-dressing and undersowing.

The Halbleib organic farm, McNabb, Illinois

He then propounded a theory which interested me very much. He said that his father had a much bigger area of orchard and had the most wonderful apples, and never sprayed or had any need to. In those days the farm was worked with sixteen horses and the orchards were always top-dressed with well-rotted horse-dung. Now the farm is worked with tractors and Mr. Halbleib wonders if there is an ecological connection between horse-dung and the apple tree. There could well be such a connection through the mychorrizal fungus. We know that fruit trees are obligate mychorriza formers, and we know from mushroom-growing that horse-dung differs from any other animal manure in its effect on fungus growth. Perhaps, when grown in large mono-culture stands, horse dung is necessary for the full vigour of the partner-fungus. An interesting hypothesis, at any rate, and Mr. Halbleib has asked Dr. Pfeiffer to do some investigation on it.

Open-pollenated corn grown and photographed by Mr. Halbleib

While on the subject of apples, I must tell of an amusing conversation I had in Vermont with the head of the horticultural department of a local college. It took place after a public meeting in the course of which he and I had been debating. He was interested in Mr. Halbleib's theory and thought he would try some experiments; but, while he was on the whole very organically minded, he expressed the view that it was not possible to dispense with spraying in the case of commercial orchards. Then, right on top of that statement, he told me of an apple orchard in his area which has been deserted for over a year. The owner left and

put it up for sale, but failed to get a buyer, so it has stood vacant. In consequence, the orchard had been thoroughly neglected. The trees have not been pruned, weeds have grown up everywhere and, of course, there has been no spraying "and as a matter of fact" he added, rather ruefully I thought, "it produced the most wonderful crop of apples last year without any pests at all."

Earthworms as Soil-Makers

Now for something rather new, Miss Bernice Warner's Earthworm Farm at Worthington, Ohio (she also is now a member). One thinks of an earthworm farm as a place that breeds earthworms for sale. Miss Warner's is not that, though she does sell some if asked to, to people who want to start a similar scheme. The purpose of her worm breeding pits is, however, to create soil, and she has quite a trade in the potting soil they make; but primarily it is for her own acre of garden that she keeps them. They are housed in shallow, open pits and are fed with all the refuse the place produces, including the garbage from her own house and from some of the neighbours. All this refuse the worms convert into soil, and this soil is used to grow her crops, than which I have never seen any healthier. It is a wonderful plan for suburban gardens.

While in Ohio, I also met the famous Mr. Edward Faulkner and saw one of his demonstration plots. Readers will remember that he is the author of Plowman's Folly and his method of maintaining fertility consists in encouraging weeds at the appropriate time and discing them into the soil. He is certainly getting wonderful results, but I remained unconvinced that this method would be sufficient to maintain fertility in all soils. I felt he tended a little to fall into the error I mentioned at the beginning of this article, that of confusing principle with technique. But I think we should be quite open-minded about it till it has been tried in many more places.

On our return journey through New Jersey, we paid a short: visit to the famous Walker-Gordon Dairies and were shown round by Mr. Jeffers himself (the inventor of the Roto-Lacter). I met him first as long ago as 1931, but the place has made great strides since then. For those who have not heard of it, I should explain that the Roto-Lacter consists of cowstalls and milking units arranged in a circle on a huge, slowly revolving platform, housed in a white-tiled palace. The cows file into these stalls at one point on the platform, while it is still moving, and stand heads to centre. By the time they reach the exit passage, they have been washed and milked and they file out again. This process goes on continuously all day, because 1,600 cows are milked in the plant three times a day. Visitors can watch this process through glass from a gallery above. Almost all the milk is retailed in New York City.

This dairy is the only one in the whole of the Eastern States that is allowed to sell raw milk, because it is so clean and the cows are so healthy. But even from here it may be sold raw only on a doctor's certificate. This makes it all the more impressive that practically the whole of this vast output is sold raw—an interesting indication of the number of doctors who prefer raw milk to pasteurised, if they can be reasonably sure of its cleanliness and of the health of the

Certainly I have never seen cattle that looked healthier or had a better bloom on them. It is an enormous farm, producing all the food for the cows and with wonderful grazing; and it is now practically 100% organic. Mr. Jeffers told me that they were now using hardly any commercial fertilizer and expected soon to be able to cut out even the little they were using. They have a big compost-making plant and also produce dehydrated cow manure for sale in bags to gardeners. I was surprised that they could be so nearly 100% organic and yet could afford to sell manure, but Mr. Jeffers said that they only did this for a part of the year and that much normally wasted material is brought in from outside. For example, crushed peanut shell and also cocoa shell are used in large quantities for bedding and then composted with the cow manure for their own fields.

I imagine that Mr. Jeffers must now be a very old man, but he doesn't behave like one. He told me that Rutgers University, some time ago, had made him a grant of $17,000 for research into the best way of composting and handling farmyard manure and, as the result of the work he did, gave him an honorary Doctor's degree. He gave a delightful chuckle and said he thinks that he is the only doctor in existence who is a doctor of cow manure!

Newspaper Mulch via Agromat

We visited several organic farms and gardens in New England, starting with Mr. Furbank's private garden, and next Mr. Bulpitt's nursery (both members). The latter is using a small agromat (see previous instalment, p. 45) and experimenting with newspaper mulch. This is done by putting garbage and paper through the agromat and then pouring the resultant thick "soup" over the ground. The water drains away and leaves this extremely finely disintegrated cellulosic material as a mulch on top. It dries hard, but it is quite porous so that rain will pass through it. It is an effective weed control and appears to be liked by the worms underneath. I think it is a little too early to pronounce judgment as to whether it can be an adequate substitute for normal compost, but it is one of the things that is worth watching.

Next we visited a Connecticut homestead belonging to Mr. and Mrs. Twitchell (the latter an acquaintance of long ago, now a member) an outstandingly attractive place in lovely surroundings. Livestock included poultry, ducks, two goats and one cow. They grow a tremendous range of vegetables and fruit and it is all organically run.

Colorado Beetle Controlled by Predator

New England provided me with some more examples of pest control through biological balance. While I was having a talk with Dr. Swanson, of the Connecticut Agricultural Experiment Station (of which more in Part IV), Miss Carnley and Mrs. Twitchell visited some of the Station's greenhouses. The man in charge told them that Colorado Beetle is now completely under control and is no longer regarded as a menace. This has been brought about by the sucessful introduction of its own predator.

Japanese Beetle is another pest which seems to be very troublesome, and at meetings in New England I was frequently asked the "biological" remedy for this. The first time this happened, I said I had no idea, because I did not know the pest, but I thought it probable there was an answer and could any member of the audience supply one. Two promptly did, confirming each other's findings that if you keep guinea fowl you will have no trouble with the Japanese Beetle.

In Vermont, we visited an organic garden belonging to a doctor who had imported organically-grown seed from Mr. Chase, of Chertsey, Surrey. He was thrilled at getting 100% germination with this seed, which in his experience was most unusual. Another very interesting visit was to a residential, co-educational preparatory school in the mountain district of Lake Placid New York State. Mr. Clark, the headmaster, is a very remarkable man, one of the all-too-rare born natural teachers. The school has for some time ' now been growing its own fruit and vegetables, and doing so organically. Mr. Clark told me that, following this, there had been a very notable drop in normal school ailments and that for some years now there has hardly ever been an occupant of the sanitorium. Some of the other teachers there, who had come on from other schools, told me that, on arrival at Lake Placid, they had all been astonished by how much more good-tempered the children were than in other schools, and how seldom they quarrelled.

We stayed for a night with our member Mr. Justin Brande (who organised the meeting where I met the horticultural professor). He has recently bought a small farm, and he and his wife are fully occupied converting it to an organic farm and raising a large, young family.

We also stayed with our member Mr. Arthur Bennett, of Rhode Island, who has a good organic garden, and from there visited a flourishing, commercial herb farm at Greene, Rhode Island. The herbs are grown organically and all the drying and packing is done on the spot. The whole place was superbly organised.

Our final visit was to a splendid conservation and organic farm at Ipswich, Massachusetts. The owner, Mr. Barclay Warburton, earlier in the year presented the Soil Association with a copy of an excellent colour film he took himself of organic farming in different parts of Africa. He wasn't a member at that time, but he now is.

I was much impressed by his use of a power-take-off muck-spreader as a compost-making and turning tool. It is operated in a stationary position by one tractor, while another fitted with front hydraulic lifter unloads into it. The material is broken up, mixed and thrown out behind to form a neat pile, the spreader being moved forward a few feet at a time as required. In this way one tool can be used for assembling the heaps, turning them and finally spreading the finished compost.

We had a most interesting dinner party at Mr. Warburton's house, during which the problem of how to deal with flies at milking time came up. Mr. Warburton told us of two devices at present being tried in America to solve this problem (D.D.T. now being practically prohibited in cow byres in several states). One of these he was installing himself because he had had such good reports of it. It is a machine which attracts flies to itself and then electrocutes them. The other was a preventive device. Fine jet nozzles are set in all round the frame of the door by which the cows enter the byre; these spray, not liquid, but cold air. When the cow passes through this cold air curtain, all the flies hurriedly leave her body and will not follow her through the door.

Inventions like this renew my confidence that the problem of controlling pests without destroying biological balance will not be beyond the ingenuity of man to solve, once he can break away from his present pre-occupation with poisons and abandon the wrong approach which this pre-occupation engenders.

PART IV

Some Findings by Agricultural Scientists

Obviously not all that I have to report under the above sub-title will be new to all my readers, but so much of it was new to me that I feel safe in assuming that much will also be new to the majority of my fellow members. It covers visits to two research stations and discussions with individual research workers; the key to the numbered references will be found on page 95. (Unfortunately, some of this material had to be withheld from publication in Mother Earth for lack of space.—Editor.)

FLORIDA STATE AGRICULTURAL RESEARCH STATION

The Florida peninsula is approximately the size of the British Isles. Its principal agricultural products are citrus fruit, sugar cane, cattle and all kinds of winter vegetables (i.e. what we think of as summer vegetables, but grown in the winter). The soils and climate of the state vary considerably, from very light sand to the peaty soils of the sub-tropical south. The headquarters of the State Agricultural Experiment Station is located at Gainsville in the north, but the field work is mainly carried out at various sub-stations.

I was not able to visit the citrus-growing district, for which I was sorry, as there are one or two organic groves there, but I heard of very interesting work which is going on at the sub-station at Lake Alfred on biological citrus pest control. Among factors recognised as affecting successful pest control through natural predators are: weather, the nutrition of the grove, individual tree resistance, and cultivation and spray practices. The scientist in charge has expressed the opinion that these last may have to be changed, or modified, to aid such controls. This is a most encouraging new approach.

I also learnt something about the sandy soil areas. The normal fertiliser programme on this soil is nitrogen, phosphate and potash in the proportions of 4:6:6, 25% of the nitrogen being in an organic form. Laboratory experiments with this soil have shown that the intake of these fertilisers by plants is very closely linked with the amount of organic matter present plus pH levels, thus much research is being devoted to means of increasing the organic matter—a difficult problem owing to the speed with which it is used up in that soil and climate. One of the principal crops of the area is winter lettuce. As a rule no second crop is taken, the remainder of the year being devoted to catch and cover cropping for green manuring. One of the plants used for this purpose is called Sesbania, which produces as much as 40 tons of green matter to the acre, all of which is disced into the soil for the next lettuce crop. The whole of this very considerable amount of organic matter is used up in one year! Interesting experiments are being made with weeds as cover crops, one of the most successful being cockleburr, considered in most places to be an extremely pernicious weed. In the Florida experiments, however, it has provided not only large amounts of raw organic matter, but is also proving very effective as a nematode control.

The only sub-station I was able actually to visit was at Belgard in the Everglade area. This southern section is only about two feet above sea level. Until comparatively recently, it was all marsh land with the typical flora and fauna of jungle swamp, including alligators. Following drainage, the soil closely resembles the English fen and some other peaty soil types, that is to say that, while it is practically 100% organic soil, it is no longer living organic matter, but inert. It has, so I was informed, no reserves of minerals at all—"the only thing it has got is nitrogen and water; we have to add everything else", the director told me. Normal fertilizer application is at the rate of 1,000 lbs. per acre of a compound containing 8 % phosphate and 12% potash.

Only a little work has been done on micro-biological life. This has shown an increased activity following the application of minerals, quite a lot of which is given in natural rock form. One of the most interesting facts is the excellent response to green manuring even on that purely organic soil. This the director

attributes to the fact that it is living organic matter as opposed to the dead organic matter which comprises the soil. He also gave me some interesting information concerning trace minerals. Molybdenum, which is toxic, reacts to pH levels in the opposite way to the other trace minerals, so that the technique of acidulating soil in order to release the required trace minerals has the effect of locking up the toxic one. A very clever provision of Nature!

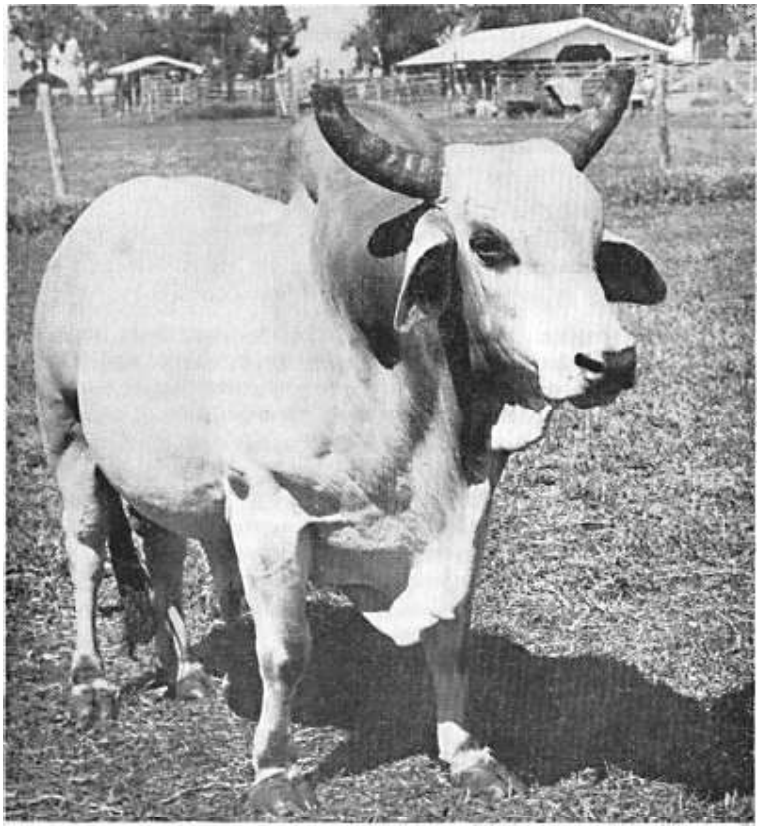
The Everglade area is very deficient in most of the trace minerals, but particularly in copper and manganese. When first brought into cultivation, it was thought that the district could become a big new cattle territory; but no cattle were able to thrive there at all until the deficiency of copper was discovered and righted. Now Florida maintains some of the largest herds of cattle in the whole of the United States. (Copper is essential to animal nutrition because it is necessary for the health of the micro-organisms in the digestive tract. 1) At the research station, they are finding that the most effective way of administering trace elements is through the leaf. Apropos of this, and as an illustration of the minute quantities required, the director told me of a crop of oats in a copper-deficient area of Holland, where the whole crop showed the recognised symptoms of copper deficiency except for a narrow strip growing under the drip-line of an overhead copper high-tension cable which crossed the field.

Spanish Moss hanging from tree (winter)

That plants may have the capacity to absorb not only the trace minerals through the leaf is suggested by the existence of the aerobic plant known as Spanish Moss, which grows everywhere we went in north Florida, Louisiana, and even in parts of Texas. This plant grows on telegraph wires as happily as on trees. It has no root and is thus not a parasite. It takes the whole of its nourishment from the air. I brought a small piece of it home with me for Dr. Milton to analyse. He tells me that its mineral content was in line with that of other plants.

The two principal breeds of cattle in the Everglade area are the Brahman, originally imported from India and able to stand the humid heat and flies better than any other breed, and the Santa Gertrudis, which are three-eights Brahman and five-eights Shorthorn. This breed was first developed in Texas and is becoming very popular in many states. The size of these herds is staggering to European eyes. As we drove towards the research station, we saw literally thousands grazing together in vast new pastures. Oddly enough, on the other side of the road there were equally large areas of vegetables stretching as far as the eye could see. I asked the director whether these grazing and vegetable areas were ever rotated, which would seem to be the best husbandry. He agreed that this

would be a good plan, but said that it was hardly ever done, because the cattle raisers were mostly men who used to raise vegetables and had got fed up with it. There seems to be a very deep-rooted preference for monoculture in America.



Brahman Bull at State Experiment Station, Belgard, Florida
(Photograph by courtesy of the director)

I think perhaps the most interesting discussion I had with the agricultural scientists in Florida concerned the selective capacity of plants, of which much more study seems to have been done in the States than in Britain. I was told that few plants had this capacity more highly developed than seaweeds. Growing side by side in the same sea water, some varieties collect sodium, others potassium, others the trace minerals in different proportions, and so on. Not for the first time, I felt how very little was known about plant nutrition when the ash theory was evolved on which fertilizer practice still so largely depends.

TEXAS RESEARCH FOUNDATION

The Texas Research Foundation at Renner, near Dallas, is an independent, non-profit, research and educational institution and is the only agricultural experiment station in the United States which is privately financed in its entirety. It does not receive one cent of tax money, or any grants from universities.

It has no less than 20 well-equipped laboratories and 512 acres of experimental farm land. This magnificent plant, valued at over a million dollars, was the gift of the founder, Mr. Hablitzelle of Dallas. Other private business men have subscribed an endowment fund, which provides an annual income of over 250,000 dollars.

It was an inspiring place to visit, and I was immensely impressed with the keenness and vision of the scientists in charge and with the really practical work

that is going on, particularly in the study of permanent pasture herbage for soil restoration. Dr. Lundell, the director, is quoted as saying, "It is really an old story. Grass made our soils, and grass will bring them back." But establishing new pastures on Texas soils, long depleted by continuous cropping, requires very special techniques. For example, on no account must they be grazed the first year, and round-the-year grazing can be achieved only by sowing some pastures to cool-season grasses and some to dry-weather grasses, and then grazing these rotationally, so that they are fed only during the growth period and rested during the dormant period. In developing the best mixtures of grasses and legumes for these pastures, palatability is one of the factors being studied.

I found the outlook of the Renner scientists to be more ecological than most of those I met at colleges and state-sponsored experiment stations, although, at present, very little biological soil work is going on. This is a gap which Dr. Laws, the soil scientist, hopes will be remedied in the future, since he is very much aware of the importance of biological mineral circulation. He was extremely interested in my account of the variations in availability revealed by Dr. Milton's work at Haughley, since initial laboratory experiments which he had begun seemed to confirm our own apparent finding that minerals remain available so long as the crop is growing, but return to the bound form when the crop is removed. Dr. Laws has been using a new method for estimating phosphate availability under a crop, which is now considered to be more reliable than any of the older methods.

He gave me some interesting information about Krilium. He said it cannot *create* a good soil structure, but it will stabilise whatever structure is present at the time of application—good, or bad. Thus, on soil that runs together when wet, if a good structure is mechanically created when weather conditions are suitable, and then Krilium is added, this structure will be maintained when the rain comes. But this stabilising effect has its dangers. He then told me the following story. Some of the early tests on Krilium were apparently made at Renner on part of the heavy, black, clay land that has been a long time in cultivation. In this soil, 50% of the organic matter originally present in the virgin soil has gone, and soil structure, consequently, has largely been destroyed. (Members will recall that Dr. Laws gave me samples of this soil, which enabled me to put on a very striking little demonstration of the importance of organic matter to soil structure at the 1953 Royal Show—see Mother Earth, October, 1953). A good seedbed to a depth of six inches was worked up mechanically, after which rows of peas were sown, Krilium having first been worked into the soil for each alternate row. When enough rain fell for the peas to germinate, the soil in the untreated rows ran together, while that in the treated ones retained its structure, with the result that the peas in the treated rows shot ahead and were soon six or seven inches higher than the untreated. Then heavy rains came and all the Krilium treated rows became waterlogged, because the Krilium had not only stabilised the six-inch depth of seedbed, but also the clay layer below, making it quite impervious. In due time the water seeped away into the subsoil in the untreated rows, so that the peas in those rows continued to grow and eventually came to maturity, while those in the treated rows wilted and died.

After my interesting discussion with Dr. Laws, I had an absorbing session with Dr. Dendy, the bio-chemist, largely on the subject of DDT contamination, which has been one of his special studies. Until recently, one of the controversial things in this most controversial subject was the method used for the detection of DDT. Now the method known as Schicker's method is universally accepted as infallible. It was not until this method was evolved and officially recognised, that Dr. Dendy's finding was accepted, namely that the presence of DDT in milk could be due to contaminated food eaten by the cow. This is no longer in dispute.

One of the most important outcomes of Schicker's method (involving the use of radio-active isotopes) is the evidence it has provided that plants can absorb unbroken, complex, organic compounds, for the method does not detect the individual ingredients of DDT, but only the presence of the whole DDT molecule. This might, so it seemed to me, have revolutionary repercussions, for much of the

argument used by orthodox agricultural scientists to counter the claim of organic cultivators is based on the theory that plants can absorb only simple chemical substances. If it can now be demonstrated that they can, after all, absorb quite a complicated organic compound, it is unlikely that this capacity will prove to be confined to one such compound. Thus the whole conception of plant nutrition as at present taught may have to be revised. This would lead automatically to new interpretations of the response of plants to compost and other organic techniques. (This view was fully confirmed later—see page 83.)

To demonstrate the extraordinary persistence of DDT, Dr. Dendy told me of a test he had carried out. A steer was raised to maturity on food known to be free from DDT contamination, except for one very short period of its fattening life when it received fodder that had been sprayed with DDT in amounts normally used in agricultural practice. After eating this for a short period, it was returned to uncontaminated food, on which it was kept for the remainder of its life. In the ordinary course of time the beast was slaughtered and its carcase converted into hog meat. This was fed to pigs that had also been carefully nurtured away from any possible source of 'DDT contamination. When these pigs, too, came to be slaughtered, quite a high concentration of DDT was found in their fat.

I asked him to comment on the publicised experiments carried out for the purpose of debunking the DDT "scare", allegedly proving it to be harmless to the higher animals and man. He said that most of these experiments were designed to study short-term exposure to fairly high concentrations. As DDT builds up in the body fat and produces toxic symptoms only when it spills over, large amounts can be stored in the body for long periods without apparent ill effect until such time as, for one reason or another, a loss of body fat occurs. To illustrate this, he described experiments he had carried out with laboratory rats and some other animals. Healthy animals in good condition were given DDT contaminated food for a short period; then, for a very long period, were again fed with uncontaminated food. During these two periods, no ill effects were exhibited. Then they were put onto a low calory diet (still free from DDT) a diet containing all that was necessary for health but one that was less fattening, so that they began to use up their own body fat. In a comparatively short time they all died of DDT poisoning. This story partly explains the extremely wide variations in susceptibility to DDT among human beings. A lean person can ingest large quantities of DDT without injury, since, there being little body fat in which to store it, little is stored. A plump person, on the other hand, stores most of the intake, which can then build up into high concentrations causing severe poisoning following loss of weight, whether due to illness, or to deliberate slimming, or any other cause.

I asked Dr. Dendy his opinion on the advisability or otherwise of using in a compost heap wastes known to have been subjected to DDT. He confirmed Dr. Pfeiffer's view that the bacteria in a compost heap will break down DDT to its simple components, which are harmless, but that it would be advisable to leave such a heap longer than an uncontaminated one.

Developing this subject, he said that the bacteria and some other simple forms of life were among the few organisms which appeared to be able to "learn" how to break it down. Experimental work had shown that after an initial fairly heavy application of DDT to soil, 73 % of the spore-bearing soil organisms are destroyed. The balance survive and repopulate the area. The next spraying does not kill more than 50 % of this new generation. If this process is continued, following each re-population, the percentage of bacteria that are killed by each subsequent application of DDT goes on decreasing until finally only 3% are destroyed. The survivors in each case are not immune in the ordinary sense of the word, but have dealt with the poison by disintegrating it. This also happens in the case of certain insects, such as flies and mosquitoes; but higher plants and animals, as well as a great many of the useful predators, seem quite unable to learn how to do it; which facts, taken together, explain why the ultimate result of spraying is often an increase of pests. This recalls the report of the Medical

Research Council on pathogenic bacterial resistance to penicillin, to which attention was called in Mother Earth (October, 1953, page 87).

Dr. Dendy confirmed that the use of DDT in cowbyres had practically ceased, because of strong disapproval by the authorities, but no steps have yet been taken to discourage its use on foodstuffs for cows.

We then discussed spray policy as a whole and the findings of organic farmers and gardeners that these destructive and dangerous agents usually cease to be necessary where crops and livestock were nurtured organically. I found his approach to pest control to be very near to our own. He wholeheartedly agreed that we had to seek root causes and that our task in tackling the spray hazard did not lie in just searching for other poisons that would do the job without being so toxic, but in "recreating the conditions in which such things were not going to be used."

W. A. ALBRECHT, Ph.D.

One of the high spots of our journey was the day spent with Dr. William Albrecht, Chairman of the Department of Soils at the College of Agriculture, University of Missouri. I had long wanted to meet him, because I had come to realise that he was a highly controversial figure, by no means universally approved of by his fellow agricultural scientists. By certain research workers, however, whose opinion carries at least equal weight, Albrecht is put in the Weston Price-McCarrison class as being one of those pioneers and original thinkers who have made a major contribution towards our understanding of nutrition.

Having met him, I wholeheartedly support this view. I found him extremely modest and undogmatic, but inflexible in his determination to follow up the clues which his very original approach to the study of soil fertility problems has revealed to him. In doing so, he has naturally formulated theories, but uses these only as working hypotheses. He would not hesitate to abandon them, if his search for truth were to show them to be faulty. He has the objectivity plus enthusiasm of the true research worker. This I believe to be at the bottom of the criticisms levelled at him from certain orthodox technologists and the extreme school of organic enthusiasts alike, because both these in their own way have set, preconceived ideas.. The scientific technologist (as apart from the true research scientist) is wedded (a) to fragmentation as opposed to wholeness and (b) to the idea that "feeling" must have no part in research (as though one could discover anything without feeling). The organic enthusiast, on the other hand, has plenty of feeling, but it is too often directed towards his own theories rather than to the search for truth.

Albrecht is a supporter of the organic school to the extent that he does accept and believe in the importance of life and the importance of the cycle. He is a critic of the orthodox to the extent that he believes that past faults have been due to what he calls the "ash mentality" as opposed to the living utilisation theory. He is by no means opposed to fertilizers as such, but does not agree with orthodox theories and practices involving their use. He believes that soluble fertilizers can be harmful, but not for the reasons put forward by the organic school. He may, or may not, be right in all his present views (he would be the first to admit this), but both sides have much to learn from him. No wonder he is sometimes unpopular!

I cannot possibly do justice to his work in the space available; but fortunately he has spoken and written widely for, and at the request of, the layman (another cause of criticism in some quarters) and reprints are available for those interested. It is from these that my few direct quotations are taken.

Here I must confine myself to summarising some of his views, as I understood them, and to describing very briefly just a few of his experiments. Many of his experiments in connection with plant nutrition are of the usual small plot or pot variety, some of them very interesting, none the less; but his thinking is based on and governed by ecological concepts. He says that, for assaying food values, no instrument as yet invented by man is so delicate and so perfect as the

living organism. That is why he is not content with any analytical methods for determining quality that have not been confirmed by results of actual feeding tests with animals. My heart warmed to him for this, because it is the belief back of the whole Haughley Experiment. The base line of his thinking throws back to the fact that, so far as we know, life emerged from the sea; therefore the sea is an environment that contains everything necessary to the living cell and its development. He is thus very keen on the use of seaweed as the safest and surest way of maintaining trace minerals.

He sees life as a biotic pyramid with soil at the base, rising through microbes, plants and animals to man at the apex, in that order. He has a very great awareness of the importance of bacteria, and one of the things that makes him really impatient is when people are just content, as he puts it, "to blame the microbe".

Because everything connected with the nutrition cycle is a living process, and the complexities increase with each level of the pyramid, he is carrying out many of his nutrition experiments with bacteria on the theory that the basic needs of all living cells are similar, and because he believes plant physiology to be much more important than anatomy.

He sees the struggle for life as the struggle for proteins. "Carbohydrates build plant bulk, but neither they nor the fats carry the power to grow. Only the proteins can transmit life, propagate themselves, multiply themselves and regenerate new cells by their own division. Life chemistry is carried on by means of the proteins. Proteins alone are the substance through which life flows."2 Thus, so his argument runs, if you study proteins, you are, in fact, studying life.

Proteins are numerous, complex and variable. There are at least 22 known amino-acids composing proteins.

> "Ten of these are specifically required for the survival of the white, laboratory rat, eight are absolutely essential for man if he is to live. It is the provision of these specific parts of the proteins, more than of merely compounds carrying nitrogen, which has probably become the major part in our struggle for good nutrition. . . . The vitamins operate through enzyme systems, the other component parts of which are generally one or more minerals and certain specific proteins." [3]

Only plants and bacteria can synthesize simple ingredients to •create proteins. Animals and men must assemble theirs from plants, other animals, or bacteria (some of them within the digestive tract). Plants require fewer amino-acids for their own growth and reproduction than do animals. Whether or not a plant contains the essential amino-acids for animal nutrition depends on the balance of minerals and other fertility factors in the soil. Two of the amino-acids essential for animal nutrition but often absent in plant protein are triptophane and methionine. Magnesium is closely concerned in the production of the former and sulphur in the latter.

Dr. Albrecht sees as the chief role of soil minerals, particularly trace minerals—whether natural or added—not their transference, as such, by plants to animals, but the capacity they give to plants themselves to construct high-quality proteins. In one of the field experiments using alfalfa grown with trace element treatments, the variation in the trace elements in the plant ash was not great enough to be detected even by spectrograph, but the trace element combination, which included magnesium, increased the triptophane in the alfalfa by 35%; and this crop, when fed to a herd of cows, cleared up breeding troubles, including abortion.

Analysis for crude protein as an indication of nutritive value is altogether too crude. "In the use of fertilizer nitrogen to increase the protein concentration in plants, one dare not assume that its mere application to the soil at any time the plant can use it will always result in proteins of equal nutritional values. If one made analyses for only crude protein, one would so conclude." [4] In one of his experiments, brome grass was grown in a series of pots in a medium of colloidal clay. To these pots were added the three positive ions of calcium, magnesium and

ammonium and the three negative ions of sulphate, phosphate and nitrate. By varying any one of these six, while the remaining five were constant (and in this colloidal clay medium all were available or exchangeable), the array of the amino-acids in the plants (thirteen of them) was altered, even though vegetative yield was constant. Therefore, the quality of the protein was varied by any one of the six fertility ions varying in the soil. Dr. Albrecht has shown by many experiments that the quality of plant protein, besides its effect on animal nutrition, is the prime factor in protecting the plant itself from disease and insect attack. There is surely a link here with the experience of organic cultivators.

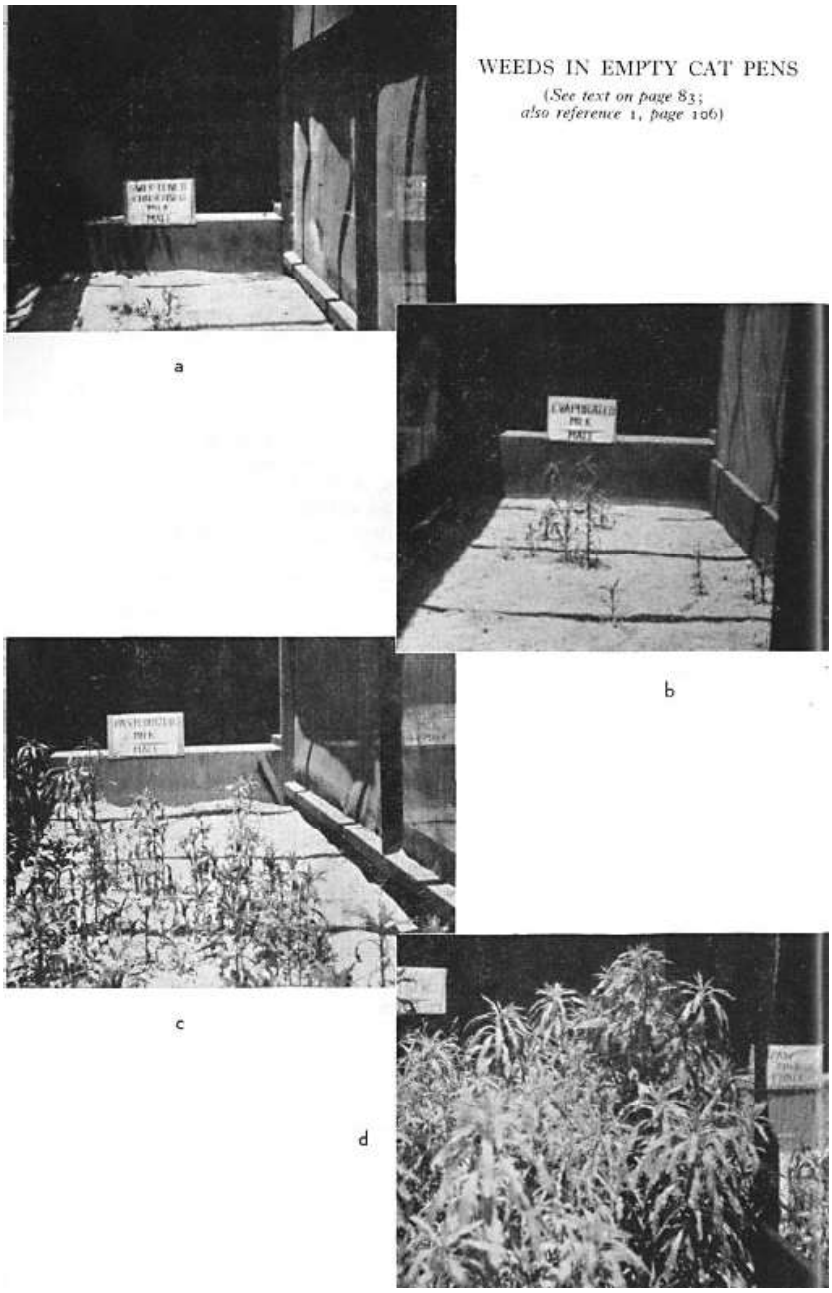
On the role of organic matter in the soil, he confirmed that plants can and do take up organic compounds, and that this is certainly an important factor in both plant and animal nutrition.

> "We have been so schooled in plant nutrition to consider only inorganic ions that we have arrived at the belief that therefore plants do not use organic compounds. . . . We are slowly coming to consider the fact that plant roots absorb organic compounds directly from the soil for metabolic services in the plant's synthesis of its own organic substances, possibly proteins." [4]

He gave me much evidence to support this view. Water extracts of organic matter in soils serve as growth hormones in the laboratory for test plants. Black currants and potatoes have been demonstrated to take up benzinehexachlorate, and plant roots can take up indole. In connection with this last, he threw a new light on Dr. Pottenger's famous cat experiments and, incidentally, on the bio-synthesis by plants of amino-acids. Members familiar with these experiments will remember that, in one, cats were fed for two years in four different pens. All feed components for these cats were constant, except the milk. Four kinds of milk were used, (a) sweetened condensed, (b) evaporated, (c) pasteurised, (d) raw. The health of the cats was in inverse ratio to that order. At the close of the experiment, volunteer weeds grew up in the pens, which had as their flooring material clean, quartz sand. The vigour of the weed growth followed the same pattern as the health of the cats (see plate page 84).

> "All the evaporated and heated milks coming by way of the cat dung apparently did not put into the sand enough fertility even to invite weed growth. Raw milk had put so much back, even after feeding the cats better, that the weed growth rilled the pens completely." [4]

As a further test, the weeds were dug in and Michigan White dwarf beans planted in all four pens. They, too, followed the same pattern as the weeds; but in this case, even growth habit was changed, for in the raw milk pen the beans ceased to be dwarf and climbed the wire six feet high. These beans were left to ripen and the seed harvested. All the seed except that from the raw milk pen smelt of cat excreta. This odour is caused by the common faecal excretions indole and scatole, which are ring compounds unbroken by digestion. Indolacetic acid is the plant hormone giving pronounced growth of roots and shoots. Indole becomes this hormone by addition to the indole ring. With little further change by addition, it becomes tryptophane, the frequently deficient, but required, amino-acid. So, having indole in the cat dung, the suggestion of a hormone to change dwarf beans into pole beans, the presence of indole odour in all the ripe seed except the "pole" beans in the raw milk pen, Dr. Albrecht's suggested interpretation is that the beans took up the indole in unbroken form, but in the case of those growing on the dung of the raw-milk fed cats it was converted into indolacetic acid, and possibly tryptophane, as part of the bean protein. He further suggested that this may very well be the normal route of travel of the organic compounds in the cycle from soil to plant to animal and back to the soil. In this particular case, two animals were involved, the cow and the cat, and the effect of merely sterilising the milk was in some way to upset the normal flow of these organic compounds in the cycle.



WEEDS IN EMPTY CAT PENS

(*See text on page 83; also reference 1, page 106*)

a

b

c

d

Dr. Albrecht believes the unerring instinct of animals for choosing food of high nutritional value to be an awareness of factors in this organic cycle, rather than of simple mineral ones. One experiment demonstrated this very clearly. Three plots of land were treated respectively with (a) lime, phosphate and potash, (b) lime and phosphate, (c) lime only. The crop rotation on each plot was a red clover ploughed down green, followed by corn (maize), followed by wheat. The three wheat crops were offered in feed hoppers simultaneously to pigs. The order of their choice was (a), (b), (c). Many workers would have been content to leave it at that—not so Albrecht. When sweet clover was substituted for red clover as a green manure crop for corn, followed by wheat, and choice of the three wheat crops was again offered to pigs, their order of preference became (b), (a), (c). In another experiment, using the same three soil treatments, corn was offered from the three plots, following sweet clover as green manure. The choice then was (c), (b), (a). When, however, the sweet clover was allowed to mature for seed and

harvested, leaving the clover trash on the ground for the corn crop, the choice for that corn crop was once more (a), (b), (c).

From these results, Albrecht argues that the hogs were not voting for the ash content of the corn or wheat resulting from the application of the minerals, nor for bulk yield, but rather for some effects prompted by the nature of the organic material turned under as green manure. In other words, "mineral fertilizers are not of influence only as minerals, rather they are in control of what products the plants manufacture in consequence of the minerals' presence in the soil." [6] Many of his other experiments have also clearly demonstrated that an increase in vegetative growth is no criterion for assuming an increase in food production.

The same fallacy, concerning the role of minerals, he believes is shown by the mineral supplement practice in compounding animal rations, which is "based on the assumption that supplementing the ration with lime or with phosphate brings the same improvement as putting these through the plant." Such reasoning he says, "gives calcium and phosphorus put into the soil no other function than to be dragged into the plant to occupy space there to be thus transported into the animal's digestive tract, as they would be if shovelled from the rock pile into the ration." [6]

This led us on to discuss his findings, not yet accepted in agricultural circles, that contagious abortion (Bang's disease) is not strictly speaking an infectious disease, but yet another deficiency disease. His evidence for this includes the case of three herds (father, two sons) brought together for the test. All were heavily infected with Bang's disease, failing seriously in calving and going down in milk output. All were kept under regular test for Bang's during the study of feeding the herd on food grown on soils treated with the most complete list of requirements, especially the trace elements, boron, manganese, copper, zinc and cobalt. During the period of four years, the calves born after improved feeding, and grown to production, remained Bang's free while in constant contact with the rest of the so-called "infected" herd. The health of the entire herd was restored, as testified by improved conception, regular calf crop and restored high milk production. These trace minerals given via the plant (i.e. after being organised by the plant) apparently prevented the entrance of the organism. Later, the same high-quality food was successfully used in curing infected animals. Strong supporting evidence for Albrecht's conclusions has been supplied by physicians who have, since his work, many times cured undulant fever in human beings (caused by the same bacillus) by using the same trace elements.

I then asked him to comment on the experiments carried out at the University of Wisconsin which claim to disprove his theory. He said these experiments were carried out from a purely fragmentary approach. Animals were infected with the disease by injecting microbes of laboratory origin, and then given the trace minerals in synthetic form, following which they continued to react. I could think of several parallels to this kind of "scientific proof"!

He was fascinating on fertility pattern in relation to climate. [7] He has a whole series of maps of the United States divided into sections from east to west. One shows rainfall, another mineral soil depletion, another protein content of grain, and another the incidence of certain human ailments such as T.B. and polio. Superimposed, these maps would all tally.

On the mineral-poor soils of the east, vegetation can produce bulk (carbohydrates); hence forests became the natural flora and the farm crops can fatten animals (even the Indians of New England apparently had to bury fish with their corn to get it to produce food that would maintain health, i.e. produce high quality protein). The great central plain was, and is, the protein-producing soil; hence the natural vegetation was the grass which could nourish the buffalo herds. He startled me by saying that these areas were kept fertile by wind erosion. Then he explained that the wide river beds of the central United States, when in flood, brought down unweathered mineral rock from the Rocky Mountains and other western districts. When these rivers became a trickle in dry weather, this silt, deposited on the dried-up river beds, blows long distances, thus some of the soil-

delivering winds, as opposed to soil-removing winds, are an important factor in soil fertility.

The disturbing thing about these maps is that the "protein line" is moving steadily west, indicating the advance of soil depletion; the average protein content of wheat in any given locality has dropped in many cases from 18% to 14% and that of corn from 9.5% to 8.5 % in ten years. The introduction of new varieties and such things as hybrid corn, to maintain yield in the face of falling fertility, only masks the cause of the drop, since yield is then maintained only at the expense of protein (i.e. feeding value), and quality protein in plant and animal is our main defence against disease. Using almost exactly the same words that Mr. Speed used to me about animals, when I saw him a year earlier, he said, "Everything that has been done in plant breeding and varieties, although it may have achieved its object, whatever that particular object was, in terms of making a more money-making product, in terms of health and stamina has every time been a retrograde step." Albrecht has no use for the cattle of the show ring, still less for the fatstock show, because he believes that fattening is merely deliberately making a sick animal and providing, therefore, sick food for human consumption.

Some of Dr. Albrecht's views on soil fertility were distinctly revolutionary (to me, at any rate), for example, that soil microbes, so immensely important in the biotic pyramid, add to fertility only when adequate minerals are present in the soil. On badly depleted soils, they can cause still further depletion. His argument is that the microbes feed first, and that they also are concerned in the universal search for proteins. Unable to use the energy of direct sunlight, as do plants, they get their energy for the synthesis of minerals from burning up the organic matter (their natural food). If that organic matter is in the form of a ploughed-in green crop *grown on the depleted soil,* it will itself be deficient in the necessary minerals, and the bacteria will suffer from protein starvation, however much organic matter may be present. They will then get first pickings at the few remaining minerals present in the colloidal clay particles, or even added minerals if these are applied near the surface. One of his recommendations for fertility building in such soils is to plough fertilizers in very deep to become reserve minerals. Plants will put down roots to this mineral supply, which is out of reach of the bacteria. The resulting crop should then be ploughed under to provide an adequate diet for the soil microbes and the whole biological flow can then start up again. For much the same reason, he holds that, on depleted soils, legumes are soil-builders only if they are ploughed in. If removed, they carry away fertility faster than the non-legumes.

Incidentally, he regarded as a racket the present tendency to offer for sale any so-called deep-rooting variety of plant. Within a given species, differences in rooting characteristics were environmental and not hereditary. A variety became deep-rooting because of the soil conditions in which it was developed. It soon reverts on going into soil conditions which do not favour deep rooting. He has had wheat which rooted as deep as thirteen feet!

On fertilizer utilisation, he said that the carbonate ion was more important than was appreciated; for example, potassium carbonate is seven times more efficient in potassium delivery than is potassium chloride. The negative inorganic ions are still "much of an unknown" in their behaviour within the soil for plant nutrition. He also said that partially acid soils were the best, because they liberated more mineral nutrients. The idea that lime was required to correct acidity was a fallacy. Its virtue lay in providing calcium and magnesium, which together with phosphorus, were the most important major minerals in protein production.

The possible danger in the use of soluble fertilizers, apart from so often leading to neglect of organic matter, lies, in his view, in their having the effect of driving off other nutrients, and various organic compounds and complexes, from the surface of the colloidal clay particles.

I end this section with a final quotation from Dr. Albrecht's own pen:

"When the effects from fertilizers on soils are measured only by yield variations in vegetative bulk, recorded in tons and bushels, there is little chance that we shall recognise crop differences demonstrating the varying effects between the use of inorganic and organic fertilizers. Our animals, however, tell us that the crop's nutritional quality reflects the different organic and inorganic compounds feeding the plants. When we learn to measure the crop's responses to soil fertility by more than bulk values and ash differences, then the contributions of the soil, both organic and inorganic, to plant nutrition will be more correctly realised." [8]

Dr. EHRENFRIED PFEIFFER

I feel that an account of our visit to Dr. Pfeiffer's laboratory at Threefold Farm, Spring Valley, New York, follows logically after that to Dr. Albrecht, for not only are both men original thinkers and true research workers in the sense already defined, but it seems to me that their tentative conclusions are very close together, despite the fact that they use quite different techniques and started from a nearly opposite original approach. Albrecht's background was the orthodox, Pfeiffer's the organic.

Dr. Pfeiffer's laboratory is now beautifully equipped and carries a large staff, including some research scientists from the universities.

More and more he is devoting this laboratory to pure research and planning to carry out his applied research by an independent organisation.

This applied research is at present very largely concerned with the decomposition of industrial wastes to render them available to agriculture, in connection with which he now has a large consulting practice. People send him samples of different waste products, which he then tests out with various combinations of bacteria (which he has now succeeded in breeding in pure culture) in order to find the bacteria best able to decompose the specific waste product in question. He has had a high measure of success with this work. In connection with it, he showed us some coloured films which were very striking. For example, one of these showed a field ploughed up, following a cabbage crop in bloom, in preparation for lettuce, half of which had been sprayed with one of his culture preparations. In this half, complete disintegration of the stalks had taken place, with a good, fine seedbed resulting. In the unsprayed half, broken stalks were still visible, both on the surface and sticking out of the furrows.

His work on mineral availability confirms the variations revealed at Haughley and he says the curves are very consistent year by year. When analysing to determine progressive soil improvement from one year to the next, he now tests only in March and September, the periods of quiescence. In the growth period, under favourable moisture conditions, he says the availability is always highest in the immediate vicinity of the roots, and root secretions, besides their well-known function as direct mineral solvents for exchange, act also as bacterial stimulants.

He has carried his leaching experiments (see Mother Earth, January, 1951) a stage further, and reports that if the organic matter content drops below 1.7%, leaching of minerals becomes very excessive indeed. His findings on the mineral intake of plants tallies with those of Dr. Albrecht and those at Florida as well as our own tentative findings at Haughley, namely—that the proportion of minerals in plants, and their intake by plants, is not always and not necessarily a direct function of the mineral fertilizers being applied.

Some of Dr. Pfeiffer's most interesting experiments have concerned the maintenance, increase, and decrease of organic matter in the soil, together with alterations in the pH values brought about, not only by different soil treatments, but by different crops. For example, a test plot was divided in half, one half being treated with an NPK formula of 5:10:5, the other half with 2/3rds manure and 1/3rd bio-dynamically treated compost, in a dressing equivalent, in terms of NPK, to the fertilizer. Eight crops were then sown in rows crossing both halves. After these had grown to the first stage of maturity, soil tests were taken from the root areas of the respective crops in both halves, and also from the fallow areas on both halves. Initial soil tests over both areas before any treatment gave organic matter 3.7% and pH 5.8. The later tests taken on the fallow areas gave: on the

mineral treated half, organic matter 2.07% and pH 5.5, and on the manure/compost treated half, organic matter 3.4% and pH 6.5.

The results of the tests from the root areas of the eight crops were as follows:— [9]

Soils from Root Areas:	Mineral.		Manure /Compost.	
Tendergreen bush beans	O.M.	2.27%	O.M.	4.77%
	pH	6.5	pH	7.0
Marglobe tomatoes	O.M.	1.8%	O.M.	4.25%
	pH	6.8	pH	7.1
Crosby's Egyptian beets	O.M.	2.87%	O.M.	5.0%
	pH	6.0	pH	7.2
Romaine head lettuce	O.M.	2.72%	O.M.	3.42%
	pH	6.0	pH	6.5
Chantenay carrots	O.M.	2.62%	O.M.	3.47%
	PH	6.0	pH	6.6
Green peppers.	O.M.	1.4%	O.M.	2.67%
	pH	5.8	pH	7.0
Golden Bantam corn	O.M.	1.77%	O.M.	2.7%
	pH	6.5	pH	6.8
Bibb's head lettuce	O.M.	3.67%	O.M.	3.65%
	pH	6.0	pH	6.3

I see in these figures a clear connection between Albrecht's theory of the movement of organic compounds in the cycle, his hog choice experiment, and our own Haughley findings of increased mineral availability under certain specific crops. A further point of interest, as Dr. Pfeiffer points out, is that such knowledge is an aid to planning crop rotations. It would seem an obvious advantage, for example, to follow a humus-consuming crop like corn or peppers with a humus-restoring crop like beans or beets.

Like Dr. Albrecht, Dr. Pfeiffer approves of dried seaweed as a livestock feeding supplement, but strongly advocates giving it separately and ad lib., thus leaving to the animal the choice of quantity. His own experience of feeding it as 10% of the ration (the common practice in England) was that after three or four months the animals became fretful and irritable. On stopping the seaweed they reverted to normal, so he thinks the animals are better judges of the quantity they require than we are (Albrecht would agree with this). More and more we are adopting this method at Haughley with marked success, judging by the variations from time to time in the quantity of seaweed consumed.

Both Albrecht and Pfeiffer depend a lot on the verdict of the animal, but while the former uses the quality of protein as his other yardstick for assaying the effects of different soil treatments on crops, Dr. Pfeiffer uses the crystallisation method. Readers of *Mother Earth* have for a long time been promised a fuller explanation of this technique, so I have taken this opportunity of quoting the following extract from an article by Dr. Pfeiffer in the Winter, 1948, issue of *Bio-Dynamics.* [9]

> "The sensitive crystallisation method, which has been developed by the writer and his co-operators in the course of 20 years, proves valuable in following up the effects of differently treated soils upon plants. The method consists mainly in the crystallisation of a 5 or 10% solution of chloride of copper to which small amounts of highly diluted plant tissue extracts are added. The solution is spread out in a thin film on a perfectly clean glass plate, 4 ins. in diameter, and crystallisation takes place in from 14 to 16 hours through evaporation of the solvent at 50-55% relative humidity and a temperature of 80°F. An air-conditioned, temperature and humidity constant cubicle, free from vibrations, is used for the crystallisation. The pattern of the crystallisation of copper chloride is changed in a characteristic manner by the minute additions. Fine rays of crystals radiating from one centre on the plate is a symptom of normal, healthy, undisturbed growth; while deficiencies, abnormalities and disease patterns show up in the formation of many centres, broken-off crystals and distorted arrangement. The interpretation of the form pattern is

facilitated by comparison with other tests of the same material made with different methods, for instance chemical analysis, vitamin content, feeding tests, pathology, etc."

The illustrations show some of the crystallisation tests carried out on some of the crops in the experiment described above. The manure/bio-dynamic compost treated crops are on the left and all show the single-centred radiating crystallisation. The mineral-only treated crops are on the right and all show the distorted pattern (see plate overleaf). Other uses to which this crystallisation test method is being put will he mentioned in Part V.

Five other workers in the agricultural field, whom I had the privilege of meeting personally, left a vivid impression on my mind, but space will only allow of a brief note about each.

DR. J. COCANNOUER

Author of *Weeds, Guardians of the Soil* and the only ecologist who has succeeded in translating the essence of that word into good Anglo-Saxon as "Nature's Togetherness Law". He is another outstanding personality, who also believes that life in the soil is the key. He considers it safe to use fertilizers only when there is a good organic buffer. He prefers using only the natural minerals, but, given adequate organic matter, regards such soluble fertilizers as superphosphate to be "quite safe in amounts up to 50 lbs., or even 75 lbs., per acre, say every four or five years". Thinking of the 5 cwt. per acre per year which comprises the usual dressing at home, I found this an interesting comment.

ANNA M. KOFFLER, Ph.D. and DR. CHARLES SCHNABEL

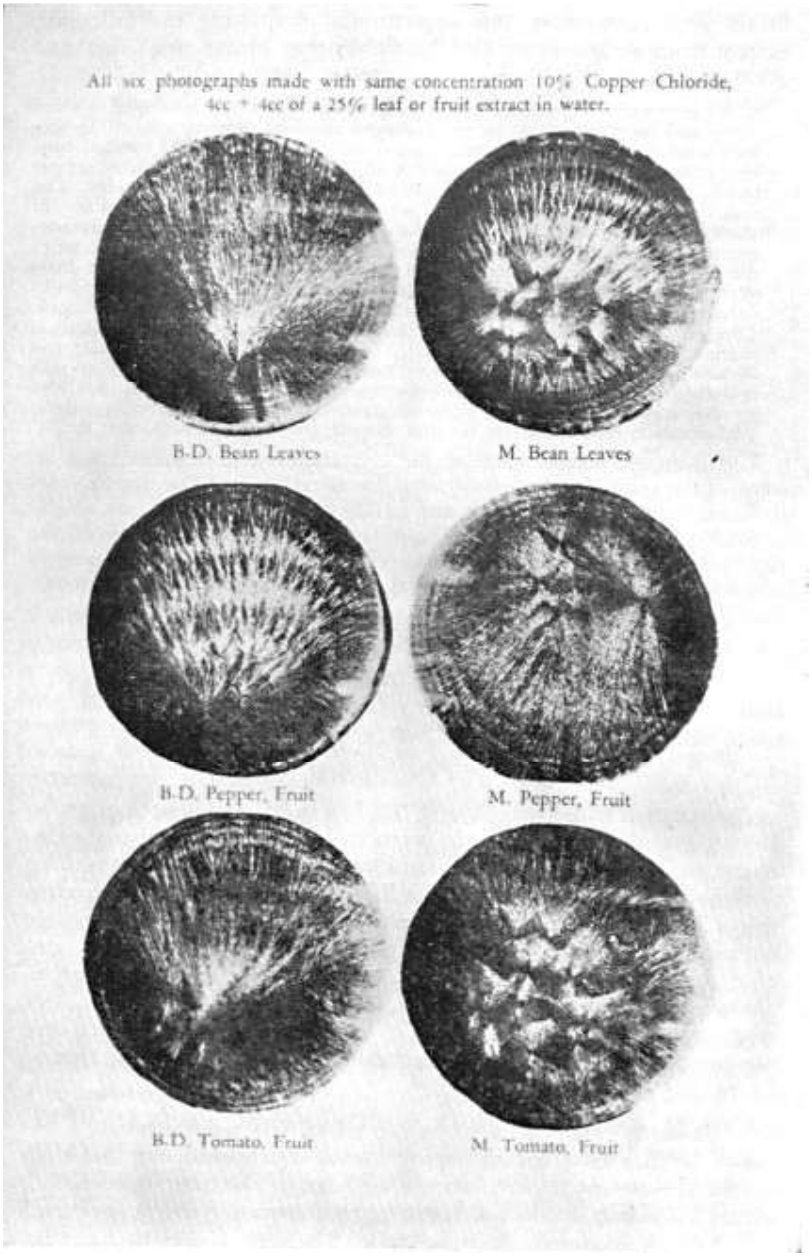
Dr. Koffler is a bacteriologist, previously working at the University of Kansas City and now associated with Dr. Charles Schnabel, whom I also met, in the production of a preparation of young, cereal grasses for human consumption, as a supplementary source of vitamins and minerals. This work is going on at Hillcrest Nutritional Farms, owned by a Mr. Pratt. Dr. Schnabel, a chemist by training, started work with grasses directly after the first world war and received an honorary degree of Doctor of Science for his discovery that "a culm of grass reaches a high peak of biologic value on the day it forms its first joint". Supporting evidence is provided by work done at Cornell showing that there is a difference between the protein in young, growing cells, and older cells which only maintain themselves. (The young grass blade is of course a vigorously growing leaf.) Research work in India has added to the evidence by showing that carotene content goes up with the protein content in young grasses, and also that copper and cobalt are present in young grasses in sufficient amounts to protect cattle from certain diseases; but as soon as the grass is over its first jointing stage those constituents start to decline until in older stages copper and cobalt are to be found in marginal, or very low, amounts.

Dr. Schnabel finds that the protein content of grasses increases tremendously by the use of seaweed, a further link with Albrecht's findings of the connection between trace minerals and the quality of proteins.

In 1934, Dr. Schnabel patented "Cerophyl" comprising cereals grown in soil made fertile with compost, natural minerals, and seaweed, and cut at the jointing stage and dried, powdered, and bottled. (From time to time, when away from my own home-grown source of food, I myself have used this product and derived considerable benefit from it.) The present and, according to Dr. Koffler, improved product no longer consists of the whole dehydrated leaf, but a concentrated extract of it.

Dr. Koffler was brought into this work as a bacteriologist and has recorded "extraordinary differences in the micro-biological response of soil bacteria caused by different types of soil treatment." Incidentally, she told me of a report she had

just received from Germany providing further evidence that the plant can take up a whole organic molecule from the soil (this time penicillin). Yet another link in the story of biosynthesis.



DR. CHESTER

Head of the Agricultural Department of the Battelle Institute of Nutrition at Columbus, Ohio. I found him eager to do research in organic growing and if Ecological Research Foundation gets going in America would welcome a chance under its auspices to repeat the Haughley Experiment at the Battelle Institute.

DR. SWANSON

I owe to Dr. Paul Sears, of Yale, my meeting with Dr. Swanson of the Connecticut Agricultural Experiment Station, a very interesting man, with a good ecological approach, but circumstances unfortunately made my time with him very short, so that there was no opportunity to ask questions except on the subject of my visit— the Experiment Station's work on the composition of earthworm casts. He gave me the report of this which makes very interesting reading. Space will not allow of extensive quotation from it, but here are just a few of the figures taken from a long table of comparative chemical analyses between earthworm casts, the adjoining soil mass to a depth of 6 ins. and soil at the 8 ins. to 16 ins. level—

	Casts.	*Soil to 6 ins.*	*Soil, 8-16 ins.*
Total Nitrogen .. percent.	0.353	0.246	0.011
Nitrate Nitrogen . . p.p.m.	21.9	4.7	1.7
Available Phosphorus p.p.m	150	20.8	8.3'
Exchangeable Calcium p.p.m	2,793	1,993	481
Exchangeable Magnesium p.p.m	492	162	69
Total Calcium .. percent.	1.19	0.88	0.91
Exchangeable Calcium as per cent. of Total Calcium ..	25.6	24.4	6.1
Exchangeable Potash p.p.m.	358	32	27

And here are a few sentences taken from the body of the report:

"Only a cursory examination of the data is needed to show the higher fertility status of the casts. . . The main benefit, chemically (and biologically), of earthworm activity is the digestion of plant material and its intimate mixing with mineral soil. . . . Both the mechanical mixing and the action of digestive secretions favour the decomposition of the organic matter and of soil minerals. . . The process may be likened to the consumption of grass, hay, and grains by cattle and the subsequent return of the manure to the soil—with this difference, however. The cattle (or the milk from cows) are sold from the farm, resulting in net loss to the soil of certain amount of plant-food. . . . The earthworm, on the other hand, dies in the soil and its decomposed body returns plant-food to the soil without loss. It has been found that the increased nitrification that takes place when earthworms are introduced into the soil is due, in part at least, to the decomposition of their own bodies. . . .

"That yields may be increased by the presence of earthworms has been demonstrated in pot culture studies. On a field scale, however, no accurate quantitative comparisons have been made, to the knowledge of the writers. Inasmuch as any practice that favours earthworm activity is also favourable to plant growth, it is extremely difficult in the field to determine to what degree the worms are responsible for any increase in yields or improvement in quality of the crop. . . . Obviously one should avoid any practice that would materially reduce earthworm activity . . . that earthworms are beneficial to the soil has been established beyond doubt."

DR. FIRMIN BEAR OF RUTGERS UNIVERSITY, NEW JERSEY

Dr. Bear is considered throughout the Eastern region to be one of America's top soil scientists. I found him exceedingly cordial and open-minded. He expressed the opinion that our Haughley Experiment was immensely worth while, though he said, with some justice, that even without looking for new factors concerning nutrition, if people would only apply those already known the improvement in national health would be dramatic. He is very much aware that agricultural practice has gone too far in a chemical direction, and all the time he is preaching and teaching not only the need for organic matter, but the need for the conservation, instead of disposal, of all forms of organic wastes. He is extremely interested in Dr. Albrecht's work, both his trace element work and, particularly, his findings on the quality of proteins. He told me this is proving most helpful in work now being undertaken at Rutgers, following up the same line of reasoning and checking Albrecht's results. He said that over-liming and excess applications of potash fertilizer were two of the commonest causes leading to the locking up of essential trace minerals in the soil. He confirmed the capacity of certain weeds to

select and collect specific trace minerals and considered that they might well, on occasion, be deliberately grown for this purpose.

REFERENCES :

[1] "The Web of Life" by John H. Storer (Devin-Adair, New York, 1953).

[2] Albrecht, W. A., Ph.D. Nitrogen for Proteins and Protection against Disease. September, 1949.

[3] Albrecht, W. A., Ph.D. More and Better Proteins Make Better Food and Feed.

[4] Albrecht, W. A., Ph.D. Protein Deficiencies via Soil Deficiencies (Part II). Oct., 1951. See also reference 1, page 106.

[5] Albrecht, W. A., Ph.D. Better Soils Make Better Hogs. June, 1947.

[6] Albrecht, W. A., Ph.D. Good Horses Require Good Soils. Dec, 1940.

[7] Albrecht, W. A., Ph.D. Nutrition via Soil Fertility according to Climate. (Specialist Conference in Agriculture. Plant and Animal Nutrition in Relation to Soil and Climatic Factors. Australia, 1949. Proceedings—H.M. Stationery Office, 1951. Pages 384-397.)

[8] Albrecht, W. A., Ph.D. The Value of Organic Matter. (Modem Nutrition, Oct./Nov., 1952. Journal of the American Nutrition Society. 6283 Wilshire Blvd., Los Angeles 48.)

[9] Bio-Dynamics, Winter, 1948. (Published by the Bio-Dynamic Farming and Gardening Association, Inc., R.D.I, Chester, New York.)

[10] H. A. Lunt and H. G. M. Jacobson. The Chemical Composition of Earthworm Casts. (Soil Science. Vol. 58, No. 5, Nov., 1944.)

PART V

Conversations with Medical Research Workers and Practitioners

(The key to the numbered references will be found on page 106)

F. M. POTTENGER, JNR., M.D.

This section must undoubtedly start with Dr. Pottenger—one of the outstanding figures today in nutrition research. He is a medical research worker who also has a private and consulting practice; thus his conclusions are drawn as much from observed and recorded data with human beings, as with laboratory animals. He has done, and is doing, some exceedingly important work. Like many others in both the human and agricultural fields today, he is finding more and more sickness, and so-called diseases, to be manifestations of malnutrition in one form or another, from deficiency of some specific food factor to devitalised food in general. He has not omitted to follow up the clues given in the famous cat experiments1 (which, incidentally, have now been repeated and confirmed in Europe) and is one of the medical men already referred to who has kept in close touch with Dr. Albrecht and his findings, and who has had outstanding success with undulant fever cases through trace mineral treatment on the lines of Albrecht's method with cattle.

I had the opportunity of two fairly long sessions with this outstanding personality, during which he touched on many aspects of the whole field of health and nutrition, including the urgent need for study of the subject from an ecological approach. In connection with this, he views the Ecological Research Foundation project with enthusiastic approval. He went so far as to express the opinion that realisation of this project would be one of the most important things that could happen, because research work in Wholeness was really the only thing that could save the human race. He said that hitherto practically the only people who were seeing things whole, and trying to study wholeness, were the non-scientists, and that if we could really form a body that would pursue this approach with scientists, it would be one of the greatest advances yet made.

He is very deeply concerned over the dangers of our increasing fragmentation, our modern food habits, and the new developments concerning the treatment of food. Particularly is he worried by the increasing use of drugs and antibiotics being given to livestock to increase their size, and the use of hormones, whether as sprays or for caponising poultry. (All caponising is now carried out in the States by injecting stillbesterol.) He is satisfied that the increased bulk produced by such practices largely consists of water (just as the increase in vegetative bulk of green crops, resulting from large doses of synthetic nitrogen, is also largely water).

In testimony given before the House of Representatives Select Committee on the use of chemicals in food, it was stated that there is less real food value in a 5 lb. capon, as produced today, than in a 3 lb. cockerel. Dr. Pottenger's own experience leads him to concur with this view. Over and above this, he believes there is serious potential danger to a consumer of food treated with these drugs and hormones. We know that when potatoes which have been sprayed with the hormone that stops them sprouting in the clamp are later fed to pigs, they have been known to cause sterility. We know that chickens' heads sold by a large poultry concern to a silver fox farm made the foxes sterile. Dr. Pottenger does not believe that the effect of a hormone injected into the neck of a cockerel, for the purpose of turning it into a capon, is confined to the seat of the injection.

Discussing health standards in general, he made an interesting comment on the frequently-heard statement that modern man must be better nourished than his forefathers because he is so much bigger. He said that we have got to separate growth from maturity, and that what is happening far too often nowadays is that growth continues because maturity does not come when it should. The so-called

increased stature is an increase of the limbs—an increase in height, not accompanied by a bigger brain-pan, a bigger thorax, a bigger abdomen—in fact there is some indication that these are actually smaller. In other words, the human frame just continues to grow, but fails to mature. He was extremely interesting on this theme, linking it up with actual examples from his own experience, including incidents concerned with adolescent "delinquency". This failure to mature is a tendency which Dr. Pottenger believes to be much increased by use of the aforesaid drugs and hormones. In other words, just as the animal is now being made to grow in size but not to mature, so will that be the fate of the consumers of this kind of meat, if it continues for more than one generation. He admits that this isn't really proved as yet, but it is an opinion based on a lot of personal experience.

We then discussed other kinds of spray hazards, such as the pesticides. He confirmed everything I had been told by Dr. Dendy concerning DDT, including the wide individual variation in susceptibility. He had known cases that were apparently able to tolerate as much as 200 parts per million in the body fat, but in his own experience any concentration over five parts per million (the generally recognised toxic level) did show definite clinical symptoms.

Dr. Pottenger is another who confirmed the fact that plants can take up organic compounds and further, that when such compounds are toxic, they can produce effects which persist into the next generation. As an example, he told me that when lindane (a carbon ring compound used as a pesticide) is used as a spray on growing potatoes, it sets up conditions which lead to the production of black tubers. If the eyes of these potatoes are carefully cut out and planted in perfectly clean, untreated soil, they grow all right; but the plants will in their turn again produce black tubers. There seems to be a close parallel here to the ten-year cat-feeding experiment in which those cats which were fed on a sterile diet developed a germ plasm injury which was also transmitted to subsequent generations.[1]

Dr. Pottenger spoke of the increasing number of toxic materials being consumed both in food and as drugs. Of the former, apart from all the many processing chemicals, he, and many of the other doctors I met, attribute much sickness to rancid fats. The new cooking fats of vegetable origin now in wide use are treated by a process that prevents the rancid flavour, but not the rancid effects; and they are used again and again in deep-frying. (Deep-fried chicken is as much an American national dish as are fish and chips in Britain.*)

On toxic drugs, Dr. Pottenger said (and this, too, was confirmed by several other doctors) that awareness of deficiencies in modern diet had led to a tremendous consumption of synthetic vitamins and a vast new vested interest was now concerned in their production and sale. Apart from the fact that only natural vitamins are effective in correcting such deficiencies, the synthetic vitamins are mainly coal-tar products, and many people believe there is good reason to suspect coal-tar products of being a possible causative factor in cancer.

Knowing that he and other nutritionists regard aspirin as one of the dangerous drugs, I asked Dr. Pottenger what he considered to be its principal ill-effects. He said it washes vitamin B clean out of the system. Vitamin B is essential for oxydising carbohydrates; and seeing that any consumption of carbohydrates in excess of the amount which can be dealt with by the vitamin B present in the body, leads to the production of an acid which is highly toxic, I feel that this is a fact that should be more generally known. The daily consumption of aspirin in Great Britain is said to be ten million tablets! When this is considered in conjunction with the excess carbohydrate intake inherent in a national diet of which refined white flour products form the base, it is small wonder that so many people feel and look poisoned.

*Mr. Barton (of Topanga, California) asked the director of a firm concerned with cooking fats why olive oil, which was such a good food, was now so difficult to get. The reply was illuminating, "Well, you see olives have to be grown and have to be picked, and then you have to get the oil from them, but all these other oils are by-products. We've got to do something with them. It's very convenient to sell them as human food."

EPILEPSY AND POLIOMYELITIS

During our tour I was given a considerable amount of evidence, from the different doctors I met, indicating just how toxic the acid produced by excess carbohydrate intake can be. For example, Dr. Trautman, whom I met at Mr. Noyes' place in Illinois (and who is, incidentally, another of the doctors who has had complete success in the treatment of undulant fever by the Albrecht-Pottenger-Allison trace mineral technique) told me that he was consulted by an epileptic—a 100% disablement case, the man having an average of five major seizures a day and being considered quite incurable. All Dr. Trautman did in this case was to take the patient off all refined sugar and white flour products. Within three days of stopping these things, the patient went three weeks without a fit. Later, Dr. Trautman improved his other feeding habits and also got him on to organically grown food. "Of course," said Dr. Trautman, "he is not absolutely cured, but his fits are now so rare that he is able to earn his living and be a useful citizen."

Another example is the famous case of a very bad epidemic of polio in a school in one of the Carolinas. The outbreak was brought to an abrupt and dramatic end by the simple means of stopping the consumption of all ice-cream and halving the consumption of white-flour products.

I was given several other examples in connection with polio. Dr. Little, who has a country practice in New York State, told me that he had never had a case among his poor patients, who could not afford sophisticated carbohydrate foods and drinks, but that the disease was common among his wealthy patients.

The same story was told me by Dr. Walsh, one of the doctors I met in California. He worked in Mexico for a long period of his professional life and has made a considerable study of Mexican diets and health standards. There is a very sharp division in Mexico between rich and poor, with little or no middle income group. He told me that polio was rife among the wealthy Mexicans, but that he had never met, or heard of, a single case among the poor Mexicans, despite the insanitary conditions in which they so commonly lived. He said that progressive medical opinion in California was more and more coming to associate polio with purely nutritional factors and mostly with the factors that usually accompany the higher income groups—the rich, sophisticated carbohydrate foods—too much refined sugar and starch, too much ice-cream, too many carbonated soft drinks, etc. These typical foods of the well-to-do American are now also the foods of the wealthy Mexican. The staple items of diet of the poor Mexicans, on the other hand, are chihlis (containing more vitamin C than citrus fruit) and beans (a protein food); therefore, even though they are frequently undernourished, these poorer classes in Mexico are not *mal*-nourished, as are the wealthy ones.

A propos of this, I must here recount a true story told me in a certain New Mexican city.

A teacher in a primary school there, which was attended by both American and Mexican children, wanted to demonstrate to the Mexican children that American customs were an advance on their own customs, and that American food habits were much better than theirs. To drive home this lesson, she set up a feeding experiment with laboratory mice, one group being put on to the diet of the American children and one on to the diet of the Mexican children. Unfortunately, from her point of view, the lesson back-fired, because the mice on the Mexican diet throve exceedingly, while those on the American diet all got sick!

To return for a moment to the subject of polio (on the question of treatment this time, rather than prevention), I met a Californian doctor who is in charge of a clinic for polio cases. He told me that outstandingly the most successful treatment was proving to be that devised by the late Nurse Kenny of Australia and that he now always used that method. I told him that English doctors had rejected it, without, as far as I could discover, giving it a fair trial. He said that it was slow to come into operation, even in America, because, besides being rather unorthodox, it seemed to be "an unlikely treatment"; but that it had more than justified itself by results.

TRACE MINERALS

At the Halbleib Orchards I met a Dr. Robinson from Kentucky. He reported that he was using a preparation made from a blend of 18 types of seaweed which, in conjunction with whole foods, was giving "extraordinary success" in the treatment of all tumour complaints, including some types of cancer. This seems to connect with Dr. Earp Thomas' treatment, whose method consists of feeding trace minerals to certain bacteria and then using a preparation made from the resultant cultures. He claims cancer cures from this treatment in every type of case, except cancer of the liver. It fails with this, because a healthy liver is necessary to utilise the cure.

You will note that in both these cases (Dr. Earp Thomas and Dr. Robinson) trace minerals were given after being organically incorporated into the living cell by the natural bio-synthesis of living function. A doctor I met at Albuquerque was another who stressed the difference between natural and synthetic minerals. He told me that when he used to prescribe synthetic minerals for patients suffering from deficiencies, they did very little good, but that as soon as he gave those supplements in food form, i.e. prescribed food rich in the required mineral, the effect was often immediate and dramatic. He has become convinced that, as is the case with vitamins, only natural minerals as bound up within a living plant or animal are effective. (This experience supports Albrecht's explanation of the failure of the Wisconsin experiment to confirm his Bang's Disease findings.)

Eroded Hills in Oklahoma (see Part II)

W. CODA MARTIN, M.D.

I later discussed the cancer claims with Dr. Coda Martin, of New York City, who is practising preventive medicine from the angle of sound nutrition, including the use of trace minerals where necessary. He said that he had, in fact, been able to control certain types of cancer in the very early stages; but no one in the medical profession likes to use the word "cured" in reference to cancer unless the patient lives for many years after it has been controlled, and his patients have not been with him for a long enough period for him to make any such claim as yet. Nevertheless, it is his belief that the basic cause of cancer is due to changes in the body chemistry brought about by dietary deficiencies over a period of years, and

that if this is true, it follows that cancer can be *prevented* by proper nutrition. Treatment by diet alone is not very satisfactory in his view, partly because, for success, nutrition must consist of food of organic origin, the supply of which is still insufficient, and partly because, except with slow types of cancer caught in the early stages, the disease moves faster than the cure can catch up. Thus, where possible, he prefers surgery to remove the localised cancer, followed by nutritional therapy to prevent a recurrence.

Dr. Martin has been making considerable use of Dr. Pfeiffer's crystallisation method for diagnosis in cancer cases. He sends blood samples to Dr. Pfeiffer, who subjects them to the crystallisation test and reports back his findings. Dr. Martin said that this method of diagnosis was giving a very high degree of accuracy indeed and is thus proving of great value. Dr. Pfeiffer is now collaborating with certain hospitals in the same way.

Dr. Martin has achieved remarkable success with mental cases and nervous disorders. Cases of epilepsy, feeble-mindedness and certain kinds of lunacy, which had been pronounced incurable, he has often found will yield to treatment on a permanent nutritional basis, and are frequently caused by mineral deficiencies.

He told me of one astonishing type of case he now has to treat. From time to time New York is subjected to what he calls "atomic rain". Apparently, after the trial explosions in Nevada, when the wind is in the right direction, radio-active particles drift right across the country and, under certain weather conditions, are actually brought down by the rain in New York City. He has one or two patients who are exceedingly sensitive to radio-active material and he has to give these people protective treatment when this phenomenon occurs.

We discussed insecticides. He told me that he now makes it a routine practice to test all patients for the presence of DDT in their tissues. He let me see the returns for 25 patients from whom samples were submitted between the 13th of one month and the 24th of the next. In only two out of the 25 was DDT absent. In seven it was present in amounts at or above the toxic level; one was over double the toxic level. He also gave me some facts about hyperkeratosis or X-Disease in cattle, which first made its appearance in 1947. This has now been shown to be due to chlorinated napthalene, another insecticide. The disease can be transmitted through milk. Between November, 1952, and February, 1953, twenty thousand cases were reported from 37 states. Reports of poisoning from chlorinated napthalene among industrial workers handling these compounds are also numerous. An even newer disease, fatal to hogs, has now made its appearance. Between July, 1952, and April, 1953, it affected 170,000 pigs.

FLUORINE

We then had a long discussion on the controversial subject of fluorine. Every doctor I met in the States was violently opposed to its compulsory inclusion in water. Dr. Martin was no exception. The evidence of the dangers of deliberately adding fluorine to drinking water is very strong indeed. The arguments in favour seem slim. They derive mainly from the presence of fluorine in that district of Texas where tooth decay is rare, but there are many other causative factors in that area, including a very high calcium content. To pick out just one factor is at best a very fragmentary approach. A bulletin issued by the University of New Mexico on fluorine poisoning published as early as 1938, ends with suggested recommendations for *removing* fluorine from water! Here are just a few short quotations from this publication [2]:

> "Cases are on record which show that ingestion of small amounts of fluorides is fatal to both man and other animals. . . .
>
> "Experiments show that fluorine passes into the blood stream and interferes with the calcification of unerupted teeth. Contrary to common belief, it does not act in the mouth upon the enamel of the erupted portion of the teeth.
>
> "The bones of fluorine-fed animals are always chalky and fragile as are the teeth.

"Measuring the storage of calcium and phosphorus, the bone forming elements, by determining the balance between the intake and the output shows that fluorine-fed animals retain only half as much as normal animals serving as controls. Fluorine increases the loss or elimination of these elements, and bone development is retarded proportionally."

This locking up or removal of other essential nutrient elements Dr. Martin regards as one of its greatest dangers.

"An inhibitory effect on the action of enzymes, characteristic of antiseptics in general, is a property of all inorganic fluorides.

"Stuber and Lang observed a number of cases of haemophilia in which the fluorine content of the blood was abnormally high. There seemed to be a correlation between the high fluorine content of the blood and the prolonged time of coagulation, and they suspected that the fluorine may be the cause of this condition. . . . Continuing their observations they found that as a whole, individuals residing in places where the fluorine content of their drinking water was high, had a coagulation time of six to twenty times that of a normal individual drinking fluorine-free water."

These observations pre-date any suggestion of deliberately adding this poison to water. An excellent recent summary of the dangers is contained in a reprint of an address given by Dr. Royal Lee, of the Lee Nutritional Foundation, Milwaukee.[3] The question is now so topical, both in the States and in Britain, and seems to me so important, that I feel space must be made for the following extracts:

"It is probable that fluorine as a food is only that kind of fluorine that has entered into an organic combination by passing through plant life before we make use of it. Inorganic fluorine is a cumulative poison, which means that it accumulates in the body even if taken in very small doses. Organic fluorine does not accumulate in the body regardless of the dosage, and is unquestionably far more effective in preventing dental decay. Whole wheat grown in Deaf Smith County, Texas, contains up to 700 p.p.m. of fluorine but never has caused fluorosis, while inorganic fluorine in drinking water may cause much fluorosis even in doses as small as .9 p.p.m.

"Many of our nutritional mineral elements are poisonous in the inorganic state, but indispensable in food in the proper organic combination. Cobalt is one, zinc is another. Organic cobalt is known as vitamin B12. When the organic form of fluorine is ultimately discovered, it probably will be identified as one of the members of a well-known vitamin complex, just as organic cobalt has been catalogued as the twelfth offspring of vitamin B complex. (The B family has at this date reached the total number of 15.)

"Inorganic cobalt is poisonous to the human system, and cannot be used in any way until converted by soil microbes into B12. Fluorine probably is worse in being a cumulative poison as it accumulates in the bones and makes them more and more brittle if taken in as the inorganic form. There is no known antidote for this process.

"So the dangers of reckless use of fluorine seem too obvious to permit the wholesale addition of this element to drinking water before the test installations are completely reported on. A 10 year period was stated to be essential before any reliable statistics were to be available. That was when the first fluoridisation was begun back in 1947. Why this haste at the present moment? Who is pushing this dangerous procedure, and why?"

He then proceeds to answer this question by suggesting that two commercial interests are involved, the manufacturers of aluminium, of which fluorine is a by-product, and the syndicate which makes the machinery for fluoridisation, which happens also to be the same as that making the apparatus for flour-bleaching. Dr. Lee continues with evidence of increased heart disease resulting directly from the loss of wheat vitamins oxydised by bleachers, "a fact that has been cleverly suppressed so that not one doctor in fifty is aware of it," and he continues:

"A syndicate that will suppress such information to make money for its members, certainly will have little compunction in saddling the use of fluorides in poison forms upon us to make us believe that we are preventing tooth decay. Maybe it will; no doubt the intestinal flora of the child will in some degree convert the inorganic fluorine into organic. But what of the greater part that is not converted, that part which remains in the bone tissues, and renders the bones brittle, and acts to poison glandular cells? For the sake of safety, we should not take in our food regime *any inorganic fluorine at all."*

MISCELLANEOUS ITEMS

Now just a few isolate items of hearsay information given to me on good authority but at second hand.

(1) Work of the utmost importance on biological pest control is going on at Kentville in Nova Scotia under the direction of Dr. Pickett, who is reported as stating that "the use of preparations like DDT in orchards, for instance, by creating resistance and by destroying natural predators of the noxious insects, *actually perpetuates the emergency* for which these compounds were used in the first place." [4]

(2) The United States Plant-Soil-Nutrition Laboratories at Cornell are at present engaged in a more comprehensive, ecological

study of nutrition than anywhere else in the world. One of the scientists concerned in this is Dr. McCay. He has demonstrated, among other things, the literal truth of the saying "The thin rat goes to the fat rat's funeral." Having maintained for a long time a strain of 100% healthy rats through sound nutrition (just as McCarrison did) living to the old age generally regarded as the full expectation of life for rats in captivity, McCay doubled their life span merely by halving their rations!

I cannot resist telling an amusing story at this point (from memory as I do not seem to have made a note of it) which was told me by Dr. Fred Miller, of Altoona.* About 25 years ago, a doctor friend of Fred Miller's who had indulged himself in the matter of food and was consequently much over-weight had, as a result of overwork, a complete physical breakdown. He consulted five specialists, none of whom gave him more than a year to live and all of whom pronounced his condition to be incurable. The subject of this verdict said that he was "much too busy to die just yet" and eventually consulted McCay, who put him on to the diet on which he fed his monkeys. The "patient" is alive today, but all five specialists are dead.

(3) An interesting sidelight on the effect of natural soil minerals on animal nutrition. In those parts of Texas where the famous Long-horn cattle used to range, this breed's characteristic and exceedingly long horns were confined to steers. The horn growth was due to the very high content of calcium in the herbage of these soils. This calcium was utilised by the breeding animals, both male and female, for reproduction, but in the case of the steers the excess intake of calcium, over and above that required by the body metabolism, went to horn growth. When these steers were removed to other districts, their excessively long horns (the spread was often 12 feet) first drooped and finally dropped off, to leave horns of normal proportion.

(4) Finally, and this is perhaps the most interesting of all, some men in Harrisburg, Pennsylvania, have effectively developed a "radionic" method of pest control, and in the treatment of diseased crops, and are using it on a commercial scale. I have no details, but from my very limited knowledge of experimental work going on in this country in the fields of radiesthesia and cosmic therapy, I deduce that the method is based on the now known fact that not only does every living organism emit vibrations of its own specific wave-form, but that this is also a characteristic of every living cell. Thus the vibrations of healthy cells are not only different from those of diseased cells, but every disease has its characteristic wave-form. The Harrisburg workers have apparently developed an apparatus for bombarding the subject on site, whether pest or plant, with radiations calculated to restore the desired equilibrium.

This is an entirely new field of exploration of which I prophesy much more will be heard in the not too distant future.

*The dental surgeon who, simply through sound nutrition, has done such wonders in enabling his patients to maintain sound teeth that he is in danger of working himself out of a job (see Mother Earth, October, 1951).

REFERENCES :

[1] POTTINGER, F. M., JNR., M.D. (Feeding experiment on cats). *American Journal of Orthodontics and Oral Surgery,* Vol. 32, No. 8, August, 1946.

(This experiment extended over 10 years and involved 900 animals. The main purpose was a comparison between cooked and raw food, though there were various sub-divisions using different combinations, such, for example, as groups of cats fed on raw meat with pasteurised milk, and others on cooked meat with raw milk. The animals who received an all-raw-food diet, both milk and meat, remained healthy and bred normal healthy litters from generation to generation, while all those of which cooked food formed the major portion of the diet, whether this were meat or milk, became progressively degenerate through succeeding generations. For example 25% of abortion occurred in the first generation and 70% in the second. The animals also fell prey to a varied range of diseases, all listed in the report, and in many cases by the third generation the kittens had become so degenerate that they failed to survive for six months. A further experiment with different kinds of milk produced the same result. The raw milk fed cats remained healthy and bred normally from generation to generation, while all those fed on other forms of milk suffered from increasing degrees of sickness, degeneration and skeletal malformation in this order—pasteurised milk, evaporated milk, and sweetened condensed milk. In later experiments cats whose general metabolism had been deranged by the cooked food were returned to a raw food diet. Complete regeneration, where it was not too late to achieve this, took four generations.

The report ends with this extremely significant statement, "The principles of growth and development are easily altered by heat and oxidation which kill living cells at every stage of the life process from the soil, through the plant and through the animal. Change is not only shown in the immediate generation but as a germ plasm injury *which manifests itself in subsequent generations of plants and animals.)*

[2] JOHN D. CLARK AND EDWARD H. MANN. A Study of the Occurrence of Fluorine in the Drinking Water of New Mexico and The Menace of Fluorine to Health. (The University of New Mexico Bulletin, August 1st, 1938.)

[3] ROYAL LEE, D.D.S. Fluorine and Dental Caries. (Lee Foundation for Nutritional Research, Milwaukee, Wisconsin.)

[4] MORTON S. BISKIND, M.D. Public Health Aspects of the New Insecticides. (Reprints available from the Soil Association. See back cover.)

POSTSCRIPT

In Part I of this long report of our 1953 American journey, I wrote as a traveller, giving my impressions of people and places.

In Parts II and III, I wrote as a reporter, supplying factual information about things I had myself seen.

In Parts IV and V, I have written as a student, drinking in and trying to digest the teachings of many experts.

In this postscript, writing neither as traveller, reporter nor student, but simply as myself, I speculate for a moment on future developments.

As though looking at life through a telescope, the ancients saw their immediate environment on a grand scale, for the stars in their courses were part of it. Following the advent of modern science, with its unavoidable fragmentation, everything suddenly shrank, as though the telescope had been swung round the wrong way. Now it seems to be starting to swing back again, for with each new discovery we are being forced to enlarge our concept.

The marvels of photosynthesis, long known but not even yet understood, told the whole story, so it was thought, of the mechanism of plant nutrition. Now we begin to see that biosynthesis is equally important.

We recognise that in every living cell, whether unicellular bacteria or one of the infinitely complex number that go to make up the bodies of the higher animals and man, we are confronted by a most marvellous biochemical factory, but is that all? Perhaps in addition we should begin to think of a cell as an electric generator and battery, and even as a kind of combined wireless transmitting and receiving set as well.

It is certain that life is governed by natural laws, but though many of these still remain hidden, their very existence is often not suspected when our search for knowledge starts from the wrong premise —that the behaviour of tangible, material plants and animals can all be explained in terms of tangible matter that can be weighed. This approach ignores the multitudinous life-energy and cosmic forces, because these, at present, appear intangible.

Their effects, however, can be tangible enough; and the more we learn, the more difficult it becomes to explain nutrition, or health, or indeed anything else concerned with life, in purely material terms.

Dr. Nichols, to whom I have already referred twice in this report, in an address called "A Concept of Totality", given to an audience of bankers (of all people), listed the principal causes of disease, placing the first three in this order: (1) emotional, (2) nutritional, (3) poisons—all three brought about through violation of natural law, or *dis*-order. Emotional disorder produces conflict, this causes tension which in its turn affects glandular secretions, so affecting digestion and all other bodily function. I would have given much to have watched the faces of his audience when this successful doctor and surgeon, and Chairman of the Board of the Atlanta (Texas) National Bank to boot, speaking of the emotional cause of disease, declared as follows: "No man can ever violate any natural law. This is the central idea of our concept of totality. The law of love is a natural law and no man can violate it." "You cannot hate your neighbour and get by with it. He will become a pain in your neck, and it makes no difference how much he may have mistreated you, you still cannot afford to hate him." "The cure for the emotional cause of disease is to stop attempting to violate the law of love."

How do all the many natural laws operate? Only ecological research in its widest sense is likely to provide the answer. All the facts I have assembled here, for instance, whether concerning protein synthesis; animal knowledge in the choice of food; diagnosis through crystallisation; radionic pest control; the power of thought on bodily function; all these are manifestations of natural law, but we do not see either the clear connection between them, or the directive force. They

are like different beads in a necklace, held together, if at all, by what is at present an invisible thread. We know from the latest discoveries of modern astronomy, and the findings of the top-ranking physical scientists, that we live in an expanding universe, that Creation, in fact, is continuous—is going on all the time. The higher mathematicians have discarded the possibility of evolution through chance. A directive intelligence, they now say, is the only explanation that fits the known facts. Shall we discover that the invisible thread holding all these "beads" together is nothing less than directed energy of Creative Mind in action?

Do I hear a murmur that this is metaphysics, and what has it to do with ecological research? Possibly everything. How big is Wholeness?

No less a person than Dr. Stine, who for many years was Research Co-Ordinator for the whole of the vast Dupont organisation, said this to me:

"Anyone who engages in fundamental research must have his feet on the ground and his eyes on the stars."

Yearlings on the Burdiss Ranch, Manhatten, Kansas

AFTERWORD

THE FENCE OR THE AMBULANCE

(Presented to me during my tour)

'Twas a dangerous cliff, as they freely confessed,
Though to walk near its crest was so pleasant:
But over its terrible edge there had slipped
A duke and many a peasant;
So the people said something would have to be done,
But their projects did not all tally:
Some said, "Put a fence round the edge of the cliff";
Some, "An ambulance down in the valley".

But the cry for the ambulance carried the day,
For it spread to the neighbouring city;
A fence may be useful or not, it is true,
But each heart became brimful of pity
For those who had slipped o'er that dangerous cliff,
And the dwellers in highway and alley
Gave pounds or gave pence, not to put up a fence,
But an ambulance down in the valley.

"For the cliff is all right if you're careful," they said;
"And if folks even slip or are dropping,
It isn't the slipping that hurts them so much
As the shock down below—when they're stopping."
So day after day when these mishaps occurred,
Quick forth would the rescuers sally
To pick up the victims who fell off the cliff,
With their ambulance down in the valley.

Then an old man remarked: "It's a marvel to me
That people give far more attention
To repairing results than to stopping the cause,
When they'd much better aim at prevention.
Let us stop at its source all this mischief", cried he,
"Come, neighbours and friends, let us rally;
If the cliff we will fence, we might almost dispense
With the ambulance down in the valley."

"Oh, he's a fanatic", the others rejoined;
"Dispense with the ambulance? Never!
He'd dispense with all charities, too if he could;
No, No! We'll support them forever.
Aren't we picking up folks just as fast as they fall?
And shall this man dictate to us? Shall he?
Why should people of sense stop to put up a fence
While their ambulance works in the valley?"

But a sensible few, who are practical, too,
Will not bear with such nonsense much longer;
They believe that prevention is better than cure,
And their party will soon be the stronger.
Encourage them, then, with your purse, voice and pen,
And (while other philanthropists dally)
They will scorn all pretence, and put up a stout fence
On the cliff that hangs over the valley.

—*Joseph Malines*