FORGET CLIMATE CHANGE

IT'S TIME TO WORRY ABOUT

SOIL CHANGE

IF YOU'RE HUMAN AND EAT FOOD, YOU NEED TO READ THIS

DR. SAHADEVA DASA

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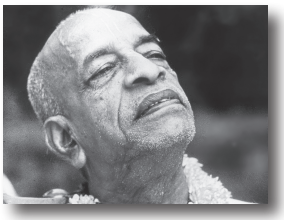
Dedicated to....

His Divine Grace A.C.Bhaktivedanta Swami Prabhupada



Mother Earth is abused in Kali-yuga in many ways. When Kali-yuga began, Maharaja Pariksit found a sudra beating the earth personified, who appeared in the form of a cow. Nowadays the earth is drilled recklessly for oil, deforested, blown up, polluted by chemicals, stripped of fertile topsoil, and filled up with cheaters and liars who create an intolerable burden.

The earth is not a dead mass to be exploited by the human species; rather, she is a living entity meant to be protected. When the earth is protected, she gives ample space and a peaceful and prosperous residence for all living entities.

~ Srila Prabhupada (Narada Bhakti Sutra 71)

By The Same Author

Oil–Final Countdown To A Global Crisis And Its Solutions
End of Modern Civilization And Alternative Future
To Kill Cow Means To End Human Civilization
Cow And Humanity – Made For Each Other
Cows Are Cool – Love 'Em!
Let's Be Friends – A Curious, Calm Cow
Wondrous Glories of Vraja
We Feel Just Like You Do
Tsunami Of Diseases Headed Our Way – Know Your Food Before Time Runs Out
Cow Killing And Beef Export – The Master Plan To Turn India Into A Desert
Capitalism Communism And Cowism – A New Economics For The 21st ` Century
Noble Cow – Munching Grass, Looking Curious And Just Hanging Around World – Through The Eyes Of Scriptures
To Save Time Is To Lengthen Life
Life Is Nothing But Time – Time Is Life, Life Is Time
Lost Time Is Never Found Again
Spare Us Some Carcasses – An Appeal From The Vultures
An Inch of Time Can Not Be Bought With A Mile of Gold
Cow Dung For Food Security And Survival of Human Race
Cow Dung – A Down To Earth Solution To Global Warming And Climate Change
Career Women – The Violence of Modern Jobs And The Lost Art of Home Making
Working Moms And Rise of A Lost Generation
Glories of Thy Wondrous Name
India A World Leader in Cow Killing And Beef Export – An Italian Did It In 10 Years
As Long As There Are Slaughterhouses, There Will Be Wars
Peak Soil – Industrial Civilization, On The Verge of Eating Itself
Corporatocracy : The New Gods – Greedy, Ruthless And Reckless
(More information on availability on DrDasa.com)

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Preface

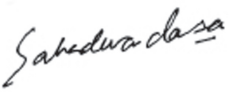
Two millenniums ago, a great fire ravaged Rome for six days, destroying 70 percent of the city and leaving half its population homeless. Rome's emperor at the time, Nero 'fiddled while Rome burned'.

Today the world is on fire and we, the modern day Neros, are busy fiddling. We are too caught up in frivolity to see the existential challenges staring us in the face. For example, climate change is for real and it's coming around faster than you think, as proven by the catastrophic events all over the world. But it has become a cliche before it has even been understood.

While we are busy merrymaking, another silent global crisis is creeping up on us. It is called soil degradation. In the past 40 years alone, 30 percent of the planet's arable land has become unproductive due to erosion. At current estimates, nearly all of the remaining 11 billion acres of cropland and grazing land suffer from some degree of erosion.

"We are overlooking soil as the foundation of all life on Earth," says Andres Arnalds, assistant director of the Icelandic Soil Conservation Service.

Essentially, all life depends upon the soil. Some one has rightly put it, "Despite all our achievements we owe our existence to a six-inch layer of topsoil and the fact that it rains."



Dr. Sahadeva dasa
7th July 2015
Secunderabad, India

1.

Soil Change

FAO defines soil change as degradation in the soil health status resulting in a diminished capacity of the ecosystem to provide goods and services for its beneficiaries. Degraded soils have a health status such, that they do not provide the normal goods and services of the particular soil in its ecosystem.

These definitions, which follow largely the LADA (Land Degradation Assessment in Drylands) definition of land degradation, are important to capture the complexity of the degradation processes and their subjective evaluation by different stakeholders in soil and land.

Soil Erosion is a common term that is often confused with soil degradation as a whole, but in fact refers only to absolute soil losses in terms of topsoil and nutrients. This is indeed the most visible effect of soil degradation, but does not cover all of its aspects. Soil erosion is a natural process in mountainous areas, but is often made much worse by poor management practices.

Land degradation has a wider scope than both soil erosion and soil degradation in that it covers all negative changes in the capacity of the ecosystem to provide goods and services.

Desertification is another common term used for (a) land degradation in dryland areas and/or (b) the irreversible change of the land to such a state it can no longer be recovered for its original use.

Mitigation And Rehabilitation

Mitigation is intervention intended to reduce ongoing degradation. This comes in at a stage when degradation has already begun. The main aim here is to halt further degradation and to start improving resources and their functions. Mitigation impacts tend to be noticeable in the short to medium term: this then provides a strong incentive for further efforts. The word 'mitigation' is also sometimes used to describe the reductions of impacts of degradation.

Rehabilitation is required when the land is already degraded to such an extent that the original use is no longer possible and the land has become practically unproductive. Here longer-term and often more costly investments are needed to show any impact.

Soil Change Matters

The International Workshop 'Soil Change Matters' in Bendigo, Australia, 24-27 March 2014, was convened to explore and discuss changes to soil in the Anthropocene (the era of human influence on the environment) – specifically, how our use of land and soil has affected soil quality and what policy responses are needed to ensure sustainability of the soil resource. The workshop brought together scientists, policy makers, land managers and other stakeholders for a forum in which over 70 separate presentations were made, ranging from the newest perspectives on soil biology to international policies for soil protection.

International Year of Soils

The United Nations have declared that 2015 is International Year of Soils and is a special time to celebrate and promote the importance of soil. Soil connects us all – food, clothes, building materials are all produced by soil, even the water we drink is filtered by soil.

Soil is culturally significant too, playing a part in our cultural enjoyment and recreation. It is the earliest material used in paintings and carries with it symbolic significance for the arts.

Soil is linked to human health, both positively and negatively. A positive example is the non-pathogenic bacterium Mycobacterium Vaccae, which occurs naturally in soil and has been linked to decreased anxiety, increased intelligence and promotes feelings of well-being.

Smell the good earth! And, one of the most exciting finds is the potential for new antibiotics to tackle antibiotic resistant bacteria. So there are many reasons to acknowledge the role played in our lives by the soil beneath our feet, 24/7.

There are a number of events being held in 2015 in honour of International Year of Soils.

World Soil Day

Recognising the importance of soils, the International Union of Soil Sciences (IUSS) made a resolution in 2002 proposing that 5th December be known as World Soil Day - to celebrate and recognise the importance of soil as a critical component of the global natural system and as a vital contributor to human well-being.

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World Soil Day 2015 : 'Soils a solid ground for life', Global Soil Partnership, Food And Agricultural Organization of The United Nations

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2.

Global Soil Change

As Serious As Climate Change

Earth's climate and biodiversity aren't the only things being dramatically affected by humans—the world's soils are also shifting beneath our feet.

'Global soil change' due to human activities is a major component of what some experts say should be recognized as a new period of geologic time: the human-made age. This new era will be defined by the pervasiveness of human environmental impacts, including changes to Earth's soils and surface geology.

Daniel Richter of Duke University, in his report published in the December 2007 issue of the journal of Soil Science, warns that Earth's soils already show a reduced capacity to support biodiversity and agricultural production. As the amount of depleted and damaged soils increases, global cycles of water, carbon, nitrogen, and other materials are also being affected.

In another paper, Jan Zalaseiwicz of the University of Leicester in England and colleagues argue that the fossil and geologic record of our time will leave distinct signatures that will be apparent far into the future.

Overworked Earth

Today about 50 percent of the world's soils are subject to direct management by humans. Global soil change is also occurring in

more remote areas due to the spread of contaminants and alterations in climate. Worldwide, soils are being transformed by human activities in ways that we poorly understand, with possibly dire implications.

The report warns that properties and processes in the soil are more dynamic and susceptible to change than previously thought. Only recently it has been documented that many aspects of soil chemistry and composition are highly responsive to human activities.

Report also warns that severe soil degradation is increasing globally at a rate of 12.4 million to 24.7 million acres (5 million to 10 million hectares) annually.

Soil Degradation And Climate Change - A Relationship

Soil degradation plays much a larger role in climate change than was previously suspected. That's because organic matter in soils store vast amounts of carbon—more than is present in the atmosphere and in all land vegetation combined.

According to the noted geologist Bruce Wilkinson of Syracuse University, heavily cultivated and degraded soils lose their carbon-storing ability as exposed organic matter breaks down.

Over the past half century or so, global soils have lost approximately a hundred billion tons of carbon [in the form of carbon dioxide] to the atmosphere through such exposure. Humans are now the predominant geological force operating on the planet.

Rates of sedimentation and erosion caused by human activities—mainly industrial agriculture—are ten times higher those attributable to natural processes. On agricultural land, soil is being lost ten times faster than it is being replaced. Humans are rapidly consuming the global soil reservoir. In light of the wasting grains to produce meat and biofuels, this is obviously a very serious change.

Source

Scott Norris, National Geographic News, February 5, 2008

Reference

James Owen, Farming Claims Almost Half Earth's Land, New Maps Show, National Geographic News, December 9, 2005

Kumar R, Das AJ (2014) Climate Change and its Impact on Land Degradation: Imperative Need to Focus. J Climatol Weather Forecasting 2:108.

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3..

World's Land Turning to Desert at Alarming Speed

United Nations Warns

The world is turning to dust, with lands the size of Rhode Island becoming desert wasteland every year and the problem threatening to send millions of people fleeing to greener countries, the United Nations says.

One-third of the Earth's surface is at risk, driving people into cities and destroying agriculture in vast swaths of Africa. Thirty-one percent of Spain is threatened, while China has lost 36,000 square miles to desert -- an area the size of Indiana -- since the 1950s.

This week the United Nations marks the 10th anniversary of the Convention to Combat Desertification, a plan aimed at stopping the phenomenon. Despite the efforts, the trend seems to be picking up speed -- doubling its pace since the 1970s."It's a creeping catastrophe," said Michel Smitall, a spokesman for the U.N. secretariat that oversees the 1994 accord. "Entire parts of the world might become uninhabitable."

I'm coming from London, Paris, and Tehran. All fields yellow. And Europe, so much scorching heat and sunshine, I never seen. Especially in London. This time I saw everything has become yellow. Greenness gone.
-Srila Prabhupada (Morning Walk — August 14, 1976, Bombay)

Slash-and-burn agriculture, sloppy conservation, overtaxed water supplies and industrialization of agriculture are mostly to blame. But global warming is taking its toll, too.

The United Nations is holding a ceremony in Bonn, Germany, to mark World Day to Combat Desertification, and will hold a meeting in Brazil to take stock of the problem.

The warning comes as a controversial movie, "The Day After Tomorrow" is whipping up interest in climate change, and as rivers and lakes dry up in the American West, giving Americans a taste of what's to come elsewhere.

The United Nations says:

* From the mid-1990s to 2000, 1,374 square miles have turned into deserts each year -- an area about the size of Rhode Island. That's up from 840 square miles in the 1980s, and 624 square miles during the 1970s.

* By 2025, two-thirds of arable land in Africa will disappear, along with one-third of Asia's and one-fifth of South America's.

* Some 135 million people -- equivalent to the populations of France and Germany combined -- are at risk of being displaced.

Most at risk are dry regions on the edges of deserts -- places like sub-Saharan Africa or the Gobi Desert in China, where people are already struggling to eke out a living from the land.

nityam udvigna-manaso durbhiksa-kara-karsitah
niranne bhu-tale rajan anavrsti-bhayaturah

In the age of Kali, people's minds will always be agitated. They will become emaciated by famine and taxation, my dear King, and will always be disturbed by fear of drought.

-Srimad Bhagavatam 12.3.39

As consumption expands, those regions have become more stressed. Trees are cut for firewood, grasslands are overgrazed, fields are over-farmed and lose their nutrients, water becomes scarcer and dirtier.

Technology can make the problem worse. In parts of Australia, irrigation systems are pumping up salty water and slowly poisoning farms. In Saudi Arabia, herdsmen can use water trucks instead of taking their animals from oasis to oasis -- but by staying in one place, the herds are getting bigger and eating all the grass.

In Spain, Portugal, Italy and Greece, coastal resorts are swallowing up water that once moistened the wilderness. Many farmers in those countries still flood their fields instead of using more miserly "drip irrigation," and the resulting shortages are slowly baking the life out of the land.

The result is a patchy "rash" of dead areas, rather than an easy-to-see expansion of existing deserts, scientists say. These areas have their good times and bad times as the weather changes. But in general, they are getting bigger and worse-off.

"It's not as dramatic as a flood or a big disaster like an earthquake," said Richard Thomas of the International Center for Agricultural Research in the Dry Areas in Aleppo, Syria. "There are some bright spots and hot spots. But overall, there is a trend toward increasing degradation."

When I first went to Hyderabad they said that for three, four years there was no rain. Is it not? But since Hare Krsna mantra is being chanted, there is rainfall. So they do not know the secret of rainfall. Yajnad bhavanti parjanyah. If you perform yajna, then there will be cloud. Parjanyad anna-sambhavah. Annad bhavanti bhutani parjanyad anna-sambhavah [Bg. 3.14]. This prescription is there. As soon as you stop performing yajna -- you take pleasure in sporting, no yajna... Now big, big cities, they have got big, big Olympian sporting, but no yajna performance. So why there shall not be scarcity of rain? And as soon as there is scarcity of rain, there is scarcity of food grains.

- Srila Prabhupada (Srimad-Bhagavatam 7.12.5 -- Bombay, April 16, 1976)

The trend is speeding up, but it has been going on for centuries, scientists say. Fossilized pollen and seeds, along with ancient tools like grinding stones, show that much of the Middle East, the Mediterranean and North Africa were once green. The Sahara itself was a savanna, and rock paintings show giraffes, elephants and cows once lived there.

Global warming contributes to the problem, making many dry areas drier, scientists say. In the last century, average temperatures have risen over 1 degree Fahrenheit worldwide, according to the U.S. Global Change Research Program.

As for the American Southwest, it is too early to tell whether its six-year drought could turn to something more permanent. But scientists note that reservoir levels are dropping as cities like Phoenix and Las Vegas expand.

"In some respects you may have greener vegetation showing up in people's yards, but you may be using water that was destined for the natural environment," said Stuart Marsh of the University of Arizona's Office of Arid Lands Studies. "That might have an effect on the biodiversity surrounding that city."

The Global Change Research Program says global warming could eventually make the Southwest wetter -- but it will also cause more extreme weather, meaning harsher droughts that could kill vegetation. Now, the Southwest drought has become so severe that even the sagebrush is dying.

"The lack of water and the overuse of water, that is going to be a threat to the United States," Thomas said. "In other parts of the world, the problem is poverty that causes people to overuse the land.

annad bhavanti bhutani
parjanyad anna-sambhavah
yajnad bhavati parjanyo
yajnah karma-samudbhavah

All living bodies subsist on food grains, which are produced from rains. Rains are produced by performance of yajna [sacrifice], and yajna is born of prescribed duties. ~ Bhagavad-gita 3.14

Most of these ecological systems have tipping points, and once you go past them, things go downhill."

By Chris Hawley, Associated Press, Published June 16, 2004

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United Nations Convention to Combat Desertification: www.unccd.int

International Center for Agricultural Research in the Dry Areas : www.icarda.org/

University of Arizona Office of Arid Lands Studies: ag.arizona.edu/OALS/oals/oals.html

4.

38% of World's Land in Danger of Turning into Desert

And now an analysis of the global desertification threat has revealed that 38% of surfaces around the world are vulnerable.

Science Daily reports:

"Researchers have measured the degradation of the planet's soil using the Life Cycle Assessment (LCA), a scientific methodology that analyses the environmental impact of human activities, and which now for the first time includes indicators on desertification. The results show that 38 percent of the world is made up of arid regions at risk of desertification."

Which is unfortunate news, to say the least. The study divided the world's land into "15 natural areas or "eco-regions" according to their degree of aridity." And 8 of those eco regions--that cover 38% of the planet--were deemed at risk of falling victim to desertification.

According to Science Daily, the 8 areas most prone to turn into desert are:

• coastal areas

Fierce national competition over water resources has prompted fears that water issues contain the seeds of violent conflict.

- Kofi Annan (UN Chief)

- the Prairies
- the Mediterranean region
- the savannah
- the temperate Steppes
- the temperate deserts
- tropical and subtropical Steppes
- the tropical and subtropical deserts

The areas at greatest risk are the subtropical deserts--areas in North Africa, Australia, and the Middle East were determined to have the highest desertification risk factor, a 7.6 out of 10. The Mediterranean region had the next highest risk. And bear in mind that while all of this sounds a little heavy on the doom and gloom side, it's very real: there are estimates that in China, for example, 1300 square miles of desert are created every year.

This sobering news means that an additional emphasis must be placed on land management and careful water conservation,

Travelling Spiritual Performers Bring Rain To Australia

For the last six years Australians have suffered the worst drought in a thousand years, say leading agriculturalists. As a result the price of food has nearly doubled in some areas. Water conservation schemes are mandated by local governments across the predominantly arid continent. Declared by politicians to be a national crisis, the situation is a recurring theme in the media and in citizens' minds.

Is it just coincidence that one of the longest uninterrupted streaks of wet weather broke at the same time Indradyumna Swami and his traveling spiritual festival team arrived on Australian shores?

Billed as 'Le Carnaval Spirituel' this vivid stage performance brings forth the timeless spiritual wisdom of ancient India's Vedic art and culture; culminating in a rousing full audience participation kirtana (call and response chanting of the Hare Krishna mantra). The European troupe of performing artists present eastern spirituality fused with a twist of the contemporary. Le Carnaval Spirituel, established in France in 1979, has for many years entertained audiences in Europe's largest music festival "Woodstock" which annually attracts crowds in excess of 250,000 people.

(From The West Australian)

especially in the most at-risk areas--unless we want to see a full third of the planet eventually get swallowed up in desert.

Source

Brian Merchant, Tree Hugger.com, February 10, 2010

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5.

Soil Depletion

Plant, Animal And Human Health Deterioration

Soil and organic matter in the soil may be considered our most important national resource. Plant and animal health and subsequently human health depends on healthy soil. Unfortunately our current farm practices have enormously reduced the supply originally present in the soil and we must expect a permanently lower level of agricultural efficiency if we do not take corrective steps urgently. An adequate supply of organic matter in the soil is vital to the survival of life on the planet.

One of the factors responsible for the global health crisis today is soil deterioration. In the Museum of Natural History (New York), is an exhibit showing the effects of soil deficiency on plant life.

These plants, all of the same kind, were reared in soils lacking some element. The exhibit has to be seen to be fully appreciated. The plants range in size from about three inches to about eighteen inches in height. Their color ranges from pale yellow to dark green. The leaves of some are broad, of others narrow. Some of the leaves are kinky. All of the plants except one is defective both in size, color and features and all except that one were raised in soil lacking some

"Of all the social and natural crises we humans face, the water crisis is the one that lies at the heart of our survival and that of our planet Earth."
-Koichiro Matsuura (the director general of Unesco)

food element. For example, one was raised in a soil lacking iron, (the plant has "anemia"), another in a soil lacking potassium, another in a soil lacking nitrogen, etc.

Deficient soil means deficient food that grows on it. Humans and animals who consume such food also naturally become nutrient deficient. If essential food elements are lacking in their foods, they, like the plants in the experiments, fail and die. Ride along the highway with an experienced farmer and he will point out fertile soil and poor soil, by the vegetation growing thereon; sickly and stunted children (as well as the obese ones) are the result of poor soil.

Empty Foods, Hollow Lives

We've all heard and read it countless times - "the best way to maintain health is to eat a balanced diet including lots of fruit and vegetables". Of course, this is absolutely correct, so long as those fruits and vegetables are not grown on the mineral-depleted soils that necessitate todays ever-increasing range of chemical 'fertilizers'.

As long ago as in 1920s, the British and US Governments were warned by nutritional experts that the soils on which most crops were grown were so deficient in mineral content that the foods grown on them contained less than 10% of the vitamins and minerals they should normally have. The intention of these reports was to highlight the problem so that remedial action could be taken to remineralise the soils, leading once again to naturally healthy fruits and vegetables.

But in last one century, no remedial action has been taken and the problem has been intensified by modern intensive farming methods. The fruits and vegetables not only have little or no vitamin and mineral content, but they are routinely sprayed with such a broad selection of chemicals that they are actually poisonous.

How Can Plants Grow Without Vitamins And Minerals?

They can! Even when the soil is burnt out, farmers can still grow good looking fruits and vegetables. Most plants require only three nutrients to grow, namely nitrogen, phosphorus and water. In the

presence of these nutrients, virtually all plants will grow into what appear to be healthy, nutritious adult specimens.

However, if the minerals found in their natural habitat are not present, such plants and their relevant fruits and vegetables will be nutritionally "empty".

As a result of this, these plants are less able to defend themselves against natural predators and are susceptible to insect attack and damage from viruses / bacteria. In order to control this, insecticides, antifungals, antibiotics, pesticides and dozens of other categories of chemicals have been designed to limit the damage done to plants by their natural enemies.

Unfortunately, many of these chemicals have not been properly tested to assess their effects on either plant or human health, and virtually none have been tested in combination to assess their combined effects. The result is that most fruits, vegetables and other plant-based foods are so contaminated with a huge variety of chemicals, and so deficient in nutrient content that they actually do more harm than good.

Source

William A. Albrecht, Loss of Soil Organic Matter and Its Restoration

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6..

Civilizations

Founded On Soil

Erosion Destroys Civilizations

Civilizations began where farming was most productive. When farm productivity declined, usually as a result of soil mismanagement, civilizations also declined - and occasionally vanished entirely.

Of the three requisites for a thriving civilization: fertile soil, a dependable water supply and relatively level land with reasonable rainfall which would not cause erosion, it is likely that the third factor was most important, and evidence is mounting that soil degradation has toppled civilizations as surely as military conquest. In countries bordering the Mediterranean, deforestation of slopes and the erosion that followed has created man-made deserts of once productive land. Ancient Romans survived on imported produce from North African regions that are desert today.

A recent study of the collapse in Guatemala around 900 AD of the 1700 year-old Mayan civilization suggests that it fell apart for similar reasons. Researchers have found evidence that population growth among the Mayans was followed by cutting trees on mountainsides to expand areas for farming. The soil erosion that resulted from growing crops on steeper and steeper slopes lowered soil productivity - both in the hills and in the valleys - to a point

where the populations could no longer survive in that area. Today only empty ruins remain.

The same process of soil degradation which destroyed civilizations in the past are still at work today.

Firstly, billions of tons of soil are being physically lost each year through accelerated erosion from the action of water and wind and by undesirable changes in soil structure.

Secondly, many soils are being degraded by increases in their salt content, by waterlogging, or by pollution through the indiscriminate application of chemical and industrial wastes.

Thirdly, many soils are losing the minerals and organic matter that make them fertile, and in most cases, these materials are not being replaced nearly as fast as they are being depleted.

Finally, millions of hectares of good farmland are being lost each year to nonfarm purposes; they are being flooded for reservoirs or paved over for highways, airports, and parking lots. The result of all this mismanagement will be less productive agricultural land at a time when meat consumption is growing and expectations are rising among people everywhere for a better life.

Source

Hubert W. Kelley, Keeping the Land Alive: Soil Erosion--its Causes and Cures, Issue 50, Food & Agriculture Org.

FAO Corporate Document Repository

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7.

Soil Replenishment

And Survival of Civilization

The history of preceding civilizations and cultures indicate the imbalances that have developed when minerals have been permanently transferred from the soil. There are only a few localities in the world where great civilizations have continued to exist through long periods and these have very distinct characteristics.

It required only a few centuries, and in some profligated systems a few decades to produce so serious a mineral depletion of the soil that progressive plant and animal deterioration resulted. In such instances, regular and adequate replenishment was not taking place.

In nature's program, minerals are loaned temporarily to the plants and animals and their return to the soil is essential. In the case of a forest system, this replenishment is made by its plant and animal life automatically. But in case of agriculture, we have to make a conscious effort to do it. A few intelligent civilizations have done it but the balance of the cultures have largely failed at this point.

Another procedure for the replenishing of the depleted soils is by the annual overflow of great river systems which float enrichment from the highlands to the lower plains. This is illustrated by the history of the rivers like the Ganges or the Nile which have carried their generous blanket of fertilizing humus and rich soil over their

long course and thus made it possible for the plains to sustain a very dense population. Where human beings have deforested vast mountainsides at the sources of these great waterways, the whole situation has reversed.

For example in China, its two great rivers, the Yangtze and the Yellow River have their source in the isolated vastness of the Himalayas in Tibet and through the centuries have provided the replenishment needed for supporting the vast population of the plains. Because of this natural replenishment, the Chinese have been exceedingly efficient in returning to the soil the minerals borrowed by the plant and animal life. Their efficiency as agriculturists has exceeded that of the residents of many other parts of the world.

But this is no longer so. Under the pressure of industrial progress, more and more of the highlands have been denuded. The forests have been ruthlessly cut down. Vast areas that nature had taken millenniums to forest have been denuded and the soil has been washed away in a few decades. These mountainsides have become a great menace instead of a great storehouse of plant food material for the plains.

The heavy rains now find little impediment and rush madly toward the plains, carrying with them not the rich vegetable matter of the previous era, but clay and rocks. This material is not good. Instead of replenishing the soil, it covers the plains with a layer of silt many feet deep, making it impossible to utilize the fertile soil underneath.

We have only to look over the departed civilizations of historic times to see the wreckage and devastation caused by these processes.

The average age of the world's greatest civilizations has been two hundred years. These nations have progressed through this sequence: from bondage to spiritual faith; from spiritual faith to great courage; from great courage to liberty; from liberty to abundance; from abundance to selfishness; from selfishness to complacency; from complacency to apathy; from apathy to dependence; from dependency back again to bondage and into oblivion. –Sir Alex Fraser Tytler

The rise and fall in succession of such cultures as those of Greece, Rome, North Africa, Spain, and many districts of Europe, have followed the pattern which we are now pursuing with great pride, under the illusion of progress.

The complacency with which the mass of the people as well as the politicians view this trend is not unlike the drifting of a merry party in the rapids over a great water fall. There seems to be no sense of impending doom.

It is apparent that the present and past one or two generations have taken more than their share of the minerals and have done so without duly returning them back. Thus they have handicapped, to a serious extent, the succeeding generations. It is not easy to replenish the minerals in the soil and it practically takes many centuries to accumulate another layer of topsoil.

This constitutes one of the serious dilemmas. A program that does not include maintaining this balance between population and soil productivity must inevitably lead to disastrous degeneration. Over-population means strife and wars.

The history of many civilizations has recorded a progressive rise while civilizations were using the accumulated nutrition in the topsoil, and a progressive decline when these civilizations were destroying these essential sources of life. Their cycle of rise and fall is strikingly duplicated in our present industrial culture.

Source

Hubert W. Kelley, Keeping the Land Alive: Soil Erosion--its Causes and Cures, Issue 50, Food & Agriculture Org.

Nutrition And Physical Degeneration, Dr. Weston A. Price

Fernández-Armesto, Felipe (2001). Civilizations: Culture, Ambition, and the Transformation of Nature. Simon & Schuster.

'The most successful and long lasting human cultures are those which have lived on nature's income rather than nature's capital.'

8.

Soil Conservation

Deserves The Highest National Priority

Why should the leaders of countries today commit their government and their people to a national programme of soil conservation?

The answer is that soil takes many years to create, but it can be destroyed in almost no time at all. With the loss of soil goes man's ability to grow food crops and graze animals, to produce fibre and forests. It is not enough to describe the soil as a country's greatest source of wealth; it is more than that; it is a country's life. And in one country after another today, the soil is washing or blowing away.

Soil Is A Complex Mixture

Soil covers most of the land surface of the earth in a thin layer, ranging from a few centimeters to several metres deep. It is composed of rock and mineral particles of many sizes mixed with water, air, and living things, both plant and animal, and their remains.

On our scale of time, soil formation is extremely slow. Where the climate is moist and warm, it takes thousands of years to form just a few centimetres of soil. In cold or dry climates, it takes even longer, or soil may not form at all. While soil is technically a renewable resource, its slow rate of formation makes it practically irreplaceable.

Soil is a dynamic mixture, forever changing as water comes and goes and plants and animals live and die. Wind, water, ice, and

gravity move soil particles about, sometimes slowly, sometimes rapidly. But even though a soil changes, the layers of soil stay much the same during one human lifetime unless they are moved or scraped, or ploughed by man.

Soil Teems With Life

It is comprised of countless species that create a dynamic and complex ecosystem and is among the most precious resources to humans.

All soil is full of life, and good soils are teeming with it. Plants and animals help keep the soil fertile. Plant roots tunnel through the soil and break it up, and decaying plants form humus. Burrowing animals mix the soil; the excrete of animals contribute nutrients and improve soil structure.

Besides the soil's more obvious inhabitants, which include rodents, insects, mites, slugs and snails, spiders, and earthworms, there are countless microscopic residents, some helpful to man and his crops, some harmful.

Good soils seem to hold the greatest populations of bacteria. Almost without exception, bacteria are involved in basic enzyme transformations that make possible the growth of higher plants, including our food crops. From man's point of view, bacteria may well be the most valuable of the life forms in soil.

Chemical reactions occur in the soil as a result of exchange of positive ions, or cations. More exchanges take place in clay soils than in any other type. These chemical reactions are also essential to plant growth and development and are a good index of soil fertility.

Source

Hubert W. Kelley, Keeping the Land Alive: Soil Erosion--its Causes and Cures, Issue 50, Food & Agriculture Org.

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9.

Soil

The Earth's Capital

Since the Industrial Revolution the processes of growth have been speeded up to produce the food and raw materials needed by the population and the factory. Nothing effective has been done to replace the loss of fertility involved in this vast increase in crop and animal production. The consequences have been disastrous.

Half of the topsoil on the planet has been lost in the last 150 years. Agriculture has become unbalanced: the land is in revolt: diseases of all kinds are on the increase: in many parts of the world Nature is removing the worn-out soil by means of erosion.

We are destroying the earth's capital—the soil; we need to aware of the consequences of this.

The maintenance of the fertility of the soil is the first condition of any permanent system of agriculture. In the ordinary processes of crop production fertility is steadily lost: its continuous restoration by means of manuring and soil management is therefore imperative.

Source

"An Agricultural Testament", by Sir Albert Howard, 1940, Oxford University Press.
Food, Farms, and Community: Exploring Food Systems, Lisa Chase, Vern Grubinger
University of New Hampshire Press, December, 2014

10.

Nature's Methods

Of Soil Management

By Sir Albert Howard, 1940

Little or no consideration is paid in the literature of agriculture to the means by which Nature manages land and conducts her water culture. Nevertheless, these natural methods of soil management must form the basis of all our studies of soil fertility.

What are the main principles underlying Nature's agriculture? These can most easily be seen in operation in our woods and forests. Mixed farming is the rule: plants are always found with animals: many species of plants and of animals all live together. In the forest every form of animal life, from mammals to the simplest invertebrates, occurs. The vegetable kingdom exhibits a similar range: there is never any attempt at monoculture: mixed crops and mixed farming are the rule.

The soil is always protected from the direct action of sun, rain, and wind. In this care of the soil strict economy is the watchword: nothing is lost. The whole of the energy of sunlight is made use of by the foliage of the forest canopy and of the undergrowth. The leaves also break up the rainfall into fine spray so that it can the more easily be dealt with by the litter of plant and animal remains which provide the last line of defence of the precious soil. These methods of protection, so effective in dealing with sun and rain,

also reduce the power of the strongest winds to a gentle air current. The rainfall in particular is carefully conserved. A large portion is retained in the surface soil: the excess is gently transferred to the subsoil and in due course to the streams and rivers. The fine spray created by the foliage is transformed by the protective ground litter into thin films of water which move slowly downwards, first into the humus layer and then into the soil and subsoil. These latter have been made porous in two ways: by the creation of a wellmarked crumb structure and by a network of drainage and aeration channels made by earthworms and other burrowing animals. The pore space of the forest soil is at its maximum so that there is a large internal soil surface over which the thin films of water can creep.

There is also ample humus for the direct absorption of moisture. The excess drains away slowly by way of the subsoil. There is remarkably little run-off, even from the primeval rain forest. When this occurs it is practically clear water. Hardly any soil is removed.

Nothing in the nature of soil erosion occurs. The streams and rivers in forest areas are always perennial because of the vast quantity of water in slow transit between the rainstorms and the sea. There is therefore little or no drought in forest areas because so much of the rainfall is retained exactly where it is needed. There is no waste anywhere.

The forest manures itself. It makes its own humus and supplies itself with minerals. If we watch a piece of woodland we find that

a gentle accumulation of mixed vegetable and animal residues is constantly taking place on the ground and that these wastes are being converted by fungi and bacteria into humus. The processes involved in the early stages of this transformation depend throughout on oxidation: afterwards they take place in the absence of air. They are sanitary. There is no nuisance of any kind—no smell, no flies, no dustbins, no incinerators, no artificial sewage system, no water-borne diseases, no town councils, and no rates. On the contrary, the forest affords a place for the ideal summer holiday: sufficient shade and an abundance of pure fresh air.

The mineral matter needed by the trees and the undergrowth is obtained from the subsoil. This is collected in dilute solution in water by the deeper roots, which also help in anchoring the trees.

Even in soils markedly deficient in phosphorus trees have no difficulty in obtaining ample supplies of this element. Potash, phosphate, and other minerals are always collected in situ and carried by the transpiration current for use in the green leaves.

Afterwards they are either used in growth or deposited on the floor of the forest in the form of vegetable waste—one of the constituents needed in the synthesis of humus. This humus is again utilized by the roots of the trees. Nature's farming, as seen in the forest, is characterized by two things: (1) a constant circulation of the mineral matter absorbed by the trees; (2) a constant addition of new mineral matter from the vast reserves held in the subsoil. There is therefore no need to add phosphates: there is no necessity for more potash salts. No mineral deficiencies of any kind occur. The supply of all the manure needed is automatic and is provided either by humus or by the soil. There is a natural division of the subject into organic and inorganic. Humus provides the organic manure: the soil the mineral matter.

The soil always carries a large fertility reserve. There is no hand to mouth existence about Nature's farming. The reserves are carried in the upper layers of the soil in the form of humus. Yet any useless accumulation of humus is avoided because it is automatically mingled with the upper soil by the activities of burrowing animals

such as earthworms and insects. The extent of this enormous reserve is only realized when the trees are cut down and the virgin land is used for agriculture. When plants like tea, coffee, rubber, and bananas are grown on recently cleared land, good crops can be raised without manure for ten years or more. Like all good administrators, therefore, Nature carries strong liquid reserves effectively invested. There is no squandering of these reserves to be seen anywhere.

The crops and live stock look after themselves. Nature has never found it necessary to design the equivalent of the spraying machine and the poison spray for the control of insect and fungous pests. There is nothing in the nature of vaccines and serums for the protection of the live stock. It is true that all kinds of diseases are to be found here and there among the plants and animals of the forest, but these never assume large proportions. The principle followed is that the plants and animals can very well protect themselves even when such things as parasites are to be found in their midst. Nature's rule in these matters is to live and let live.

If we study the prairie and the ocean we find that similar principles are followed. The grass carpet deals with the rainfall very much as the forest does. There is little or no soil erosion: the run-off is practically clear water. Humus is again stored in the upper soil.

The best of the grassland areas of North America carried a mixed herbage which maintained vast herds of bison. No veterinary service was in existence for keeping these animals alive. When brought into cultivation by the early settlers, so great was the store of fertility that these prairie soils yielded heavy crops of wheat for many years without live stock and without manure.

In lakes, rivers, and the sea, mixed farming is again the rule: a great variety of plants and animals are found living together: nowhere does one find monoculture. The vegetable and animal wastes are again dealt with by effective methods. Nothing is wasted. Humus again plays an important part and is found everywhere in solution, in suspension, and in the deposits of mud. The sea, like the forest and the prairie, manures itself.

The main characteristic of Nature's farming can therefore be summed up in a few words. *Mother earth never attempts to farm without livestock;* she always raises mixed crops; great pains are taken to preserve the soil and to prevent erosion; the mixed vegetable and animal wastes are converted into humus; there is no waste; the processes of growth and the processes of decay balance one another; ample provision is made to maintain large reserves of fertility; the greatest care is taken to store the rainfall; both plaints and animals are left to protect themselves against disease.

In considering the various man-made systems of agriculture, which so far have been devised, it will be interesting to see how far Nature's principles have been adopted, whether they have ever been improved upon, and what happens when they are disregarded.

Source

Sir Albert Howard, An Agricultural Testament - Nature's methods of soil management., 1940, Oxford University Press. ISBN: 0-8785-7060-8

Leslie A. Duram, Encyclopedia of Organic, Sustainable, and Local Food, ABC-CLIO, 2010.

11.

Transformation Of A Farmer

Into A Bandit

By Sir Albert Howard, 1940

The wheel of life is made up of two processes—growth and decay. The one is the counterpart of the other. The processes of decay which round off and complete the wheel of life can be seen in operation on the floor of any woodland. It can be seen how the mixed animal and vegetable wastes are converted into humus and how the forest manures itself.

Such are the essential facts in the wheel of life. Growth on the one side: decay on the other. In Nature's farming a balance is struck and maintained between these two complementary processes.

The only man-made systems of agriculture—those to be found in the East—which have stood the test of time have faithfully copied this rule in Nature. It follows therefore that the correct relation between the processes of growth and the processes of decay is the first principle of successful farming. Agriculture must always be balanced. If we speed up growth we must accelerate decay. If, on the other hand, the soil's reserves are squandered, crop production ceases to be good farming: it becomes something very different.

The farmer is transformed into a bandit.

Source: "An Agricultural Testament", by Sir Albert Howard, 1940, Oxford University Press.

12.

The Agriculture Of The Nations

Which Have Passed Away

By Sir Albert Howard, 1940

The difficulties inherent in the study of the agriculture of the nations which are no more are obvious. Unlike their buildings, where it is possible from a critical study of the buried remains of cities to reproduce a picture of bygone civilizations, the fields of the ancients have seldom been maintained. The land has either gone back to forest or has been used for one system of farming after another.

Peruvian Legacy

In one case, however, the actual fields of a bygone people have been preserved together with the irrigation methods by which these lands were made productive. No written records, alas, have come down to us of the staircase cultivation of the ancient Peruvians, perhaps one of the oldest forms of Stone Age agriculture.

This arose either in mountains or in the upland areas under grass because of the difficulty, before the discovery of iron, of removing the dense forest growth. In Peru irrigated staircase farming seems to have reached its highest known development. More than twenty years ago the National Geographical Society of the United States sent an expedition to study the relics of this ancient method of

agriculture, an account of which was published by O. F. Cook in the Society's Magazine of May 1916, under the title: 'Staircase Farms of the Ancients.'

The system of the megalithic people of old Peru was to construct a stairway of terraced fields up the slopes of the mountains, tier upon tier, sometimes as many as fifty in number. The outer retaining walls of these terraces were made of large stones which fit into one another with such accuracy that even at the present day, like those of the Egyptian pyramids, a knife blade cannot be inserted between them.

After the retaining wall was built, the foundation of the future field was prepared by means of coarse stones covered with clay. On this basis layers of soil, several feet thick, originally imported from beyond the great mountains, were super-imposed and then levelled for irrigation. The final result was a small flat field with only just sufficient slope for artificial watering.

In other words, a series of huge flower pots, each provided with ample drainage below, was prepared with incredible labour by this ancient people for their crops. Such were the megalithic achievements in agriculture, beside which 'our undertakings sink into insignificance in face of what this vanished race accomplished. The narrow floors and steep walls of rocky valleys that would appear utterly worthless and hopeless to our engineers were transformed, literally made over, into fertile lands and were the homes of teeming populations in pre-historic days' (O. F. Cook).

The engineers of old Peru did what they did through necessity because iron, steel, reinforced concrete, and the modern power units had not been invented. The plunder of the forest soil was beyond their reach.

These terraced fields had to be irrigated. Water had to be led to them over immense distances by means of aqueducts. Prescott states that one which traversed the district of Condesuyu measured between four and five hundred miles. Cook gives a photograph of one of these channels as a thin dark line traversing a steep mountain wall many hundreds of feet above the valley.

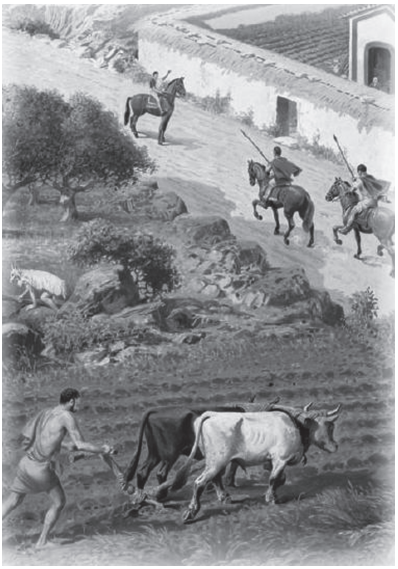
Modern Day Semblance

These ancient methods of agriculture are represented at the present day by the terraced cultivation of the Himalayas, of the mountainous areas of China and Japan, and of the irrigated rice fields so common in the hills of South India, Ceylon, and the Malayan Archipelago.

Conway's description, published in 1894, of the terraces of Hunza on the North-West Frontier of India and of the canal, carried for long distances across the face of precipices to the one available supply of perennial water—the torrent from the Ultor glacier—tallies almost completely with what he found in 1901 in the Bolivian Andes.

This distinguished scholar and mountaineer considered that the native population of Hunza of the present day is living in a stage of civilization that must bear no little likeness to that of the Peruvians under Inca government. An example of this ancient method of farming has thus been preserved through the ages. This relic of the past is interesting from the point of view of quality in food as well as from its historical value.

Rome - The Sword And The Ploughshare



Some other systems of agriculture of the past have come down to us in the form of written records which have furnished ample material for constructive research.

In the case of Rome in particular a fairly complete account of the position of agriculture, from the period of the monarchy to the fall of the Roman Empire, is available; the facts can be conveniently followed in the writings of Mommsen, Heitland, and other

scholars. In the case of Rome the Servian Reform (Servius Tullius, 578-534 B.C.) shows very clearly not only that the agricultural class originally preponderated in the State but also that an effort was made to maintain the collective body of freeholders as the pith and marrow of the community. The conception that the constitution itself rested on the freehold system permeated the whole policy of Roman war and conquest. The aim of war was to increase the number of its freehold members.

'The vanquished community was either compelled to merge entirely into the yeomanry of Rome, or, if not reduced to this extremity, it was required, not to pay a war contribution or a fixed tribute, but to cede a portion, usually a third part, of its domain, which was thereupon regularly occupied by Roman farms.

Many nations have gained victories and made conquests as the Romans did; but none has equalled the Roman in thus making the ground he had won his own by the sweat of his brow, and in securing by the ploughshare what had been gained by the lance.

That which is gained by war may be wrested from the grasp by war again, but it is not so with the conquests made by the plough; whilst the Romans lost many battles, they scarcely ever on making peace ceded Roman soil, and for this result they were indebted to the tenacity with which the farmers clung to their fields and homesteads.

The strength of man and of the State lies in their dominion over the soil; the strength of Rome was built on the most extensive and immediate mastery of her citizens over the soil, and on the compact unity of the body which thus acquired so firm a hold.' (Mommsen)

Capitalist System Vs. Sound Agricultural Practices

Decay Sets In As Large Estates Takeover

The farmland of India had remained fertile for hundreds of thousands of years by the application of cow dung. But now, because of cow slaughter, India has a shortage of cow dung for fertilizer, and chemical fertilizer has ruined the land, killing the soil. Venishakar M. Vasu says, "If we destroy our cattle wealth, not even God can save this country."

~ Lavangalatika Devi Dasi

These splendid ideals did not persist. During the period which elapsed between the union of Italy and the subjugation of Carthage, a gradual decay of the farmers set in; the small-holdings ceased to yield any substantial clear return; the cultivators one by one faced ruin; the moral tone and frugal habits of the earlier ages of the Republic were lost; the land of the Italian farmers became merged into the larger estates.

The landlord capitalist became the centre of the subject. He not only produced at a cheaper rate than the farmer because he had more land, but he began to use slaves. The same space which in the olden time, when small-holdings prevailed, had supported from a hundred to a hundred and fifty families was now occupied by one family of free persons and about fifty, for the most part unmarried, slaves. 'If this was the remedy by which the decaying national economy was to be restored to vigour, it bore, unhappily, an aspect of extreme resemblance to disease' (Mommsen).

The main causes of this decline appear to have been fourfold: the constant drain on the manhood of the country-side by the legions, which culminated in the two long wars with Carthage; the operations of the Roman capitalist landlords which 'contributed quite as much as Hamilcar and Hannibal to the decline in the vigour and the number of the Italian people' (Mommsen); failure to work out a balanced agriculture between crops and live stock and to maintain the fertility of the soil; the employment of slaves instead of free labourers.

During this period the wholesale commerce of Latium passed into the hands of the large landed proprietors who at the same time were the speculators and capitalists. The natural consequence was the

"Human society needs only sufficient grain and sufficient cows to solve its economic problems. All other things but these two are artificial necessities created by man to kill his valuable life at the human level and waste his time in things which are not needed."

~Srila Prabhupada

(Srimad Bhagavatam 3.2.29)

destruction of the middle classes, particularly of the small-holders, and the development of landed and moneyed lords on the one hand and of an agricultural proletariat on the other.

The power of capital was greatly enhanced by the growth of the class of tax-farmers and contractors to whom the State farmed out its indirect revenues for a fixed sum. Subsequent political and social conflicts did not give real relief to the agricultural community.

Colonies founded to secure Roman sovereignty over Italy provided farms for the agricultural proletariat, but the root causes of the decline in agriculture were not removed in spite of the efforts of Cato and other reformers.

A capitalist system of which the apparent interests were fundamentally opposed to a sound agriculture remained supreme. The last half of the second century saw degradation and more and more decadence.

Then came Tiberius Gracchus and the Agrarian Law with the appointment of an official commission to counteract the diminution of the farmer class by the comprehensive establishment of new small-holdings from the whole Italian landed property at the disposal of the State: eighty thousand new Italian farmers were provided with land.

These efforts to restore agriculture to its rightful place in the State were accompanied by many improvements in Roman agriculture which, unfortunately, were most suitable for large estates.

Land no longer able to produce corn became pasture; cattle now roamed over large ranches; the vine and the olive were cultivated with commercial success. These systems of agriculture, however, had to be carried on with slave labour, the supply of which had to be maintained by constant importation.

Such extensive methods of farming naturally failed to supply sufficient food for the population of Italy. Other countries were called upon to furnish essential foodstuffs; province after province was conquered to feed the growing proletariat with corn. These areas in turn slowly yielded to the same decline which had taken place in Italy.

Finally the wealthy classes abandoned the depopulated remnants of the mother country and built themselves a new capital at Constantinople. The situation had to be saved by a migration to fresh lands. In their new capital the Romans relied on the unexhausted fertility of Egypt as well as on that of Asia Minor and the Balkan and Danubian provinces.

Judged by the ordinary standards of achievement the agricultural history of the Roman Empire ended in failure due to inability to realize the fundamental principle that the maintenance of soil fertility coupled with the legitimate claims of the agricultural population should never have been allowed to come in conflict with the operations of the capitalist.

The most important possession of a country is its population. If this is maintained in health and vigour everything else will follow; if this is allowed to decline nothing, not even great riches, can save the country from eventual ruin. It follows, therefore, that the strongest possible support of capital must always be a prosperous and contented country-side. *A working compromise between agriculture and finance should therefore have been evolved. Failure to achieve this naturally ended in the ruin of both.*

Source

Sir Albert Howard, An Agricultural Testament - Nature's methods of soil management., 1940, Oxford University Press. ISBN: 0-8785-7060-8

13.

The Practices Of The Orient

By Sir Albert Howard, 1940

In the agriculture of Asia we find ourselves confronted with a system of peasant farming which in essentials soon became stabilized. What is happening to-day in the small fields of India and China took-place many centuries ago. There is here no need to study historical records or to pay a visit to the remains of the megalithic farming of the Andes.

The agricultural practices of the Orient have passed the supreme test—they are almost as permanent as those of the primeval forest, of the prairie or of the ocean. The small holdings of China, for example, are still maintaining a steady output and there is no loss of fertility after forty centuries of management.

What are the chief characteristics of this Eastern farming? The holdings are minute. Taking India as an example, the relation

In the seventh century, Hwen Thsang visited Mathura. "The people [of Mathura] are soft and easy-natured," wrote Hwen Thsang, "and take delight in performing meritorious works with a view to a future life." At that time, the soil was fertile, and grain grew abundantly. Cotton of a fine texture was cultivated, and there were great forests of mango trees. Hwen Thsang even described the two different types of mango: the large, which remains green, and the small, which turns yellow as it ripens.

between man power and cultivated area is referred to in the Census Report of 1931 as follows: 'For every agriculturalist there is 2.9 acres of cropped land of which 0.65 of an acre is irrigated. The corresponding figures of 1921 are 2.7 and 0.61.'

These figures illustrate how intense is the struggle for existence in this portion of the tropics. These small-holdings are often cultivated by extensive methods (those suitable for large areas) which utilize neither the full energies of man or beast nor the potential fertility of the soil.

If we turn to the Far East, to China and Japan, a similar system of small-holdings is accompanied by an even more intense pressure of population both human and bovine.

In the introduction to Farmers of Forty Centuries, King states that the three main islands of Japan had in 1907 a population of 46,977,000, maintained on 20,000 square miles of cultivated fields. This is at the rate of 2,349 to the square mile or more than three people to each acre.

In addition, Japan fed on each square mile of cultivation a very large animal population—69 horses and 56 cattle, nearly all employed in labour; 825 poultry; 13 swine, goats, and sheep.

Although no accurate statistics are available in China, the examples quoted by King reveal a condition of affairs not unlike that in Japan. In the Shantung Province a farmer with a family of twelve kept one donkey, one cow, and two pigs on 2.5 acres of cultivated land—a density of population at the rate of 3,072 people, 256 donkeys, 256 cattle, and 512 pigs per square mile.

The average of seven Chinese holdings visited gave a maintenance capacity of 1,783 people, 212 cattle or donkeys, and 399 pigs—nearly 2,000 consumers and 400 rough food transformers per square mile of farmed land. In comparison with these remarkable figures, the corresponding statistics for 1900 in the case of the United States per square mile were: population 61, horses and mules 30.

Two Hungers—The Stomach And The Machine

Food and forage crops are predominant. *The primary function of Eastern agriculture is to supply the cultivators and their cattle with*

food. This automatically follows because of the pressure of the population on the land: *the main hunger the soil has to appease is that of the stomach. A subsidiary hunger is that of the machine which needs raw materials for manufacture.*

This extra hunger is new but has developed considerably since the opening of the Suez Canal in 1869 (by which the small fields of the cultivator have been brought into effective contact with the markets of the West) and the establishment of local industries like cotton and jute. To both these hungers soil fertility has to respond. We know from long experience that the fields of India can respond to the hunger of the stomach.

Whether they can fulfil the added demands of the machine remains to be seen. The Suez Canal has only been in operation for seventy years. The first cotton mill in India was opened in 1818 at Fort Gloster, near Calcutta. The jute industry of Bengal has grown up within a century. Jute was first exported in 1838. The first jute mill on the Hoogly began operations in 1855.

These local industries as well as the export trade in raw products for the use of the factories of the West are an extra drain on soil fertility. Their future wellbeing and indeed their very existence is only possible provided adequate steps are taken to maintain this fertility.

Human society's means of living is clearly mentioned here as 'visa', or agriculture and the business of distributing agricultural products, which involves transport, banking, etc. Industry is an artificial means of livelihood, and large-scale industry especially is the source of all the problems of society. In Bhagavad-gita also the duties of the vaisyas, who are engaged in 'visa', are stated as cow protection, agriculture and business. We have already discussed that the human being can safely depend on the cow and agricultural land for his livelihood.

~ Srila Prabhupada (Srimad Bhagavatam 3.6.32)

There is obviously no point in establishing cotton and jute mills in India, in founding trading agencies like those of Calcutta and in building ships for the conveyance of raw products unless such enterprises are stable and permanent. It would be folly and an obvious waste of capital to pursue such activities if they are founded only on the existing store of soil fertility.

All concerned in the hunger of the machine— government, financiers, manufacturers, and distributors—must see to it that the fields of India are equal to the new burden which has been thrust upon her during the last fifty years or so. The demands of commerce and industry on the one hand and the fertility of the soil on the other must be maintained in correct relation the one to the other.

The response of India to the two hungers—the stomach and the machine—will be evident from a study of Table 1, in which the area in acres under food and fodder crops is compared with that under money crops. The chief food crops in order of importance are rice, pulses, millets, wheat, and fodder crops. The money crops are more varied; cotton and oil seeds are the most important, followed by jute and other fibres, tobacco, tea, coffee, and opium. It will be seen that food and fodder crops comprise 86 percent of the total area under crops and that money crops, as far as extent is concerned, are less important, and constitute only one-seventh of the total cultivated area.

One interesting change in the production of Indian food crops has taken place during the last twenty-five years. The output of sugar used to be insufficient for the towns, and large quantities were imported from Java, Mauritius, and the continent of Europe. Today, thanks to the work at Shahjahanpur in the United Provinces, the new varieties of cane bred at Coimbatore and the protection now enjoyed by the sugar industry, India is almost self-supporting as far as sugar is concerned. The pre-war average amount of sugar imported was 634,000 tons; in 1937-8 the total had fallen to 14,000 tons.

TABLE I

Agricultural Statistics of British India, 1935-36 Area, in acres, under **food and fodder crops**	
Rice	79,888,000
Millets	38,144,000
Wheat	25,150,000
Gram	14,897,000
Pulses and other food grains	29,792,000
Fodder crops	10,791,000
Condiments, spices, fruits, vegetables, and miscellaneous food crops	8,308,000
Barley	6,178,000
Maize	6,211,000
Sugar	4,038,000
Total, food and fodder crops	**223,397,000**
Area, in acres, under **money crops**	
Cotton	15,761,000
Oil seeds, chiefly ground-nuts, sesamum, rape, mustard, and linseed	15,662,000
Jute and other fibres	2,706,000
Dyes, tanning materials, drugs, narcotics, and miscellaneous money crops	1,458,000
Tobacco	1,230,000
Tea	787,000
Coffee	97,000
Indigo	40,000
Opium	10,000
Total, money crops	**37,751,000**

In Africa and Australia they have so much land -- and instead of relying on nature's bounty of crops, they are raising cattle to kill them. This is their intelligence. People are growing coffee and tea and tobacco, even though they know these things hurt their health. In some parts of the world people are dying for want of grain, and yet in other parts of the world people are growing tobacco, which will only bring disease and death. This is their intelligence.
~ Srila Prabhupada (Back To Godhead, #14-11, 1979)

Following In Nature's Footsteps

Mixed crops are the rule. In this respect the cultivators of the Orient have followed Nature's method as seen in the primeval forest. Mixed cropping is perhaps most universal when the cereal crop is the main constituent. Crops like millets, wheat, barley, and maize are mixed with an appropriate subsidiary pulse, sometimes a species that ripens much later than the cereal.

The pigeon pea (Cajanus indicus Spreng.), perhaps the most important leguminous crop of the Gangetic alluvium, is grown either with millets or with maize. The mixing of cereals and pulses appears to help both crops. When the two grow together the character of the growth improves.

Do the roots of these crops excrete materials useful to each other? Is the mycorrhizal association found in the roots of these tropical legumes and cereals the agent involved in this excretion? Science at the moment is unable to answer these questions: it is only now beginning to investigate them.

Here we have another instance where the peasants of the East have anticipated and acted upon the solution of one of the problems which Western science is only just beginning to recognize. Whatever may be the reason why crops thrive best when associated in suitable combinations, the fact remains that mixtures generally give better results than monoculture.

This is seen in Great Britain in the growth of dredge corn, in mixed crops of wheat and beans, vetches and rye, clover and rye-grass, and in intensive vegetable growing under glass. The produce raised under Dutch lights has noticeably increased since the mixed cropping of the Chinese vegetable growers of Australia has been copied. Mr. F. A. Secrett was, I believe, the first to introduce this system on a large scale into Great Britain. He informed me that he saw it for the first time at Melbourne.

A balance between live stock and crops is always maintained. Although crops are generally more important than animals in Eastern agriculture, we seldom or never find crops without animals. This is because oxen are required for cultivation and buffaloes for

milk. Nevertheless, the waste products of the animal, as is often the case in other parts of the world, are not always fully utilized for the land.

The Chinese have for ages past recognized the importance of the urine of animals and the great value of animal wastes in the preparation of composts. In India far less attention is paid to these wastes and a large portion of the cattle dung available is burnt for fuel.

Although half a million examples of the connection between a fertile soil and a healthy plant exist in India alone, and these natural experiments have been in operation for centuries before experiment stations like Rothamsted were ever thought of, modern agricultural science takes no notice of the results and resolutely refuses to accept them as evidence, largely because they lack the support furnished by the higher mathematics.

Leguminous plants are common. Although it was not till 1888, after a protracted controversy lasting thirty years, that Western science finally accepted as proved the important part played by pulse crops in enriching the soil, centuries of experience had taught the peasants of the East the same lesson.

The leguminous crop in the rotation is everywhere one of their old fixed practices. In some areas, such as the Indo-Gangetic plain, one of these pulses—the pigeon pea—is also made use of as a subsoil cultivator. The deep spreading root system is used to promote the aeration of the closely packed silt soils, which so closely resemble those of the Holland Division of Lincolnshire in Great Britain.

Cultivation is generally superficial and is carried out by wooden ploughs furnished with an iron point. Soil-inverting ploughs, as used in the West for the destruction of weeds, have never been designed by Eastern peoples.

The reasons for this appear to be two: (1) soil inversion for the destruction of weeds is not necessary in a hot climate where the same work is done by the sun for nothing; (2) the preservation of the level of the fields is essential for surface drainage, for preventing local waterlogging, and for irrigation.

Another reason for this surface cultivation has recently been pointed out. The store of nitrogen in the soil in the form of organic matter has to be carefully conserved: it is part of the cultivator's working capital. Too much cultivation and deep ploughing would oxidize this reserve and the balance of soil fertility would soon be destroyed.

Rice is grown whenever possible. By far the most important crop in the East is rice. In India, as has already been pointed out, the production of rice exceeds that of any two food crops put together,

Whenever the soil and water supply permit, rice is invariably grown. A study of this crop is illuminating. At first sight rice appears to contradict one of the great principles of the agricultural science of the West, namely, the dependence of cereals on nitrogenous manures.

Large crops of rice are produced in many parts of India on the same land year after year without the addition of any manure whatever. The rice fields of the country export paddy in large quantities to the centres of population or abroad, but there is no corresponding import of combined nitrogen. Where does the rice crop obtain its nitrogen? One source in all probability is fixation from the atmosphere in the submerged algal film on the surface of the mud. Another is the rice nursery itself, where the seedlings are raised on land heavily manured with cattle dung.

Large quantities of nitrogen and other nutrients are stored in the seedling itself; this at transplanting time contains a veritable arsenal of reserves of all kinds which carry the plant successfully through this process and probably also furnish some of the nitrogen needed during subsequent growth. The manuring of the rice seedling illustrates a very general principle in agriculture, namely, the importance of starting a crop in a really fertile soil and so arranging matters that the plant can absorb a great deal of what it needs as early as possible in its development.

There is an adequate supply of labour. Labour is everywhere abundant, as would naturally follow from the great density of the rural population. Indeed, in India it is so great that if the leisure

time of the cultivators and their cattle for a single year could be calculated as money at the local rates a perfectly colossal figure would be obtained. This leisure, however, is not altogether wasted.

It enables the cultivators and their oxen to recover from the periods of intensive work which precede the sowing of the crops and which are needed at harvest time. At these periods time is everything: everybody works from sunrise to sunset. The preparation of the land and the sowing of the crops need the greatest care and skill; the work must be completed in a very short time so that a large labour force is essential.

Taking Burma as an example of an area exporting rice beyond seas, during the twenty years ending 1924, about 25,000,000 tons of paddy have been exported from a tract roughly 10,000,000 acres in area. As unhusked rice contains about 1.2 percent of nitrogen the amount of this element, shipped overseas during twenty years or destroyed in the burning of the husk, is in the neighbourhood of 300,000 tons.

As this constant drain of nitrogen is not made up for by the import of manure, we should expect to find a gradual loss of fertility.

Agriculture is the noblest profession. It makes society happy, wealthy, healthy, honest, and spiritually advanced for a better life after death. The vaisya community, or the mercantile class of men, take to this profession. In Bhagavad-gita the vaisyas are described as the natural agriculturalists, the protectors of cows, and the general traders. When Lord Sri Krsna incarnated Himself at Vrndavana, He took pleasure in becoming a beloved son of such a vaisya family. Nanda Maharaja was a big protector of cows, and Lord Sri Krsna, as the most beloved son of Nanda Maharaja, used to tend His father's animals in the neighboring forest. By His personal example Lord Krsna wanted to teach us the value of protecting cows. Nanda Maharaja is said to have possessed nine hundred thousand cows, and at the time of Lord Sri Krsna (about five thousand years ago) the tract of land known as Vrndavana was flooded with milk and butter. Therefore God's gifted professions for mankind are agriculture and cow protection.

~ Srila Prabhupada (Light of Bhagavata, Verse 9)

Nevertheless, this does not take place either in Burma or in Bengal, where rice has been grown on the same land year after year for centuries. Clearly the soil must obtain fresh supplies of nitrogen from somewhere, otherwise the crop would cease to grow. The only likely source is fixation from the atmosphere, probably in the submerged algal film on the surface of the mud. This is one of the problems of tropical agriculture which is now being investigated.

It will be observed that in this peasant agriculture the great pressure of population on the soil results in poverty, most marked where, as in India, extensive methods are used on small-holdings which really need intensive farming. It is amazing that in spite of this unfavourable factor soil fertility should have been preserved for centuries: *this is because natural means have been used and not artificial manures. The crops are able to withstand the inroads of insects and fungi* without a thin film of protective poison.

Source

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14.

The Agricultural Methods Of The West

By Sir Albert Howard, 1940

If we take a wide survey of the contribution which is being made by the fields of the West, we find that they are engaged in trying to satisfy no less than three hungers: (1) the local hunger of the rural population, including the live stock; (2) the hunger of the growing urban areas, the population of which is unproductive from the point of view of soil fertility; and (3) the hunger of the machine avid for a constant stream of the raw materials required for manufacture.

The urban population during the last century has grown out of all knowledge; the needs of the machine increase as it becomes more and more efficient; falling profits are met by increasing the output of manufactured articles. All this adds to the burden on the land and to the calls on its fertility.

It will not be without interest to analyze critically the agriculture of the West and see how it is fitting itself for its growing task. This can be done by examining its main characteristics. These are as follows: The holding tends to increase in size. There is a great variation in the size of the agricultural holdings of the West from the small family units of France and Switzerland to the immense collective farms of Russia and the spacious ranches of the United States and Argentina.

Side by side with this growth in the size of the farm is the diminution of the number of men per square mile. In Canada, for example, the number of workers per 1,000 acres of cropped land fell from 26 in 1911 to 16 in 1926. Since these data were published the size of the working population has shrunk still further. This state of things has arisen from the scarcity and dearness of labour which has naturally led to the study of labour-saving devices.

Monoculture is the rule. Almost everywhere crops are grown in pure culture. Except in temporary leys, mixed crops are rare. On the rich prairie lands of North America even rotations are unknown: *crops of wheat follow one another and no attempt is made to convert the straw into humus by means of the urine and dung of cattle.* The straw is a tiresome encumbrance and is burnt off annually.

The machine is rapidly replacing the animal. Increasing mechanization is one of the main features of Western agriculture. Whenever a machine can be invented which saves human or animal labour its spread is rapid. Engines and motors of various kinds are the rule everywhere. The electrification of agriculture is beginning. The inevitable march of the combine harvester in all the wheat producing areas of the world is one of the latest examples of the mechanization of the agriculture of the West.

Cultivation tends to be quicker and deeper. There is a growing feeling that the more and the deeper the soil is stirred the better will be the crop. The invention of the gyrotiller, a heavy and expensive soil churn, is one of the answers to this demand. The slaves of the Roman Empire have been replaced by mechanical slaves.

The replacement of the horse and the ox by the internal combustion engine and the electric motor is, however, attended by one great disadvantage. *These machines do not produce urine and dung and so contribute nothing to the maintenance of soil fertility.* In this sense the slaves of Western agriculture are less efficient than those of ancient Rome.

Artificial manures are widely used. The feature of the manuring of the West is the use of artificial manures. The factories engaged during the Great War in the fixation of atmospheric nitrogen

for the manufacture of explosives had to find other markets, the use of nitrogenous fertilizers in agriculture increased, until to-day the majority of farmers and market gardeners base their manurial programme on the cheapest forms of nitrogen (N), phosphorus (P), and potassium (K) on the market. What may be conveniently described as the NPK mentality dominates farming alike in the experimental stations and the country-side. Vested interests, entrenched in time of national emergency, have gained a stranglehold.

Artificial manures involve less labour and less trouble than farm-yard manure. The tractor is superior to the horse in power and in speed of work: it needs no food and no expensive care during its long hours of rest. These two agencies have made it easier to run a farm. A satisfactory profit and loss account has been obtained. For the moment farming has been made to pay. But there is another side to this picture. *These chemicals and these machines can do nothing to keep the soil in good heart.* By their use the processes of growth can never be balanced by the processes of decay. All that they can accomplish is the transfer of the soil's capital to current account.

That this is so will be much clearer when the attempts now being made to farm without any animals at all march to their inevitable failure.

Diseases are on the increase. With the spread of artificials and the exhaustion of the original supplies of humus, carried by every fertile soil, there has been a corresponding increase in the diseases of crops and of the animals which feed on them. If the spread of foot-and-mouth disease in Europe and its comparative insignificance among well fed animals in the East are compared, or if the comparison is made between certain areas in Europe, the conclusion is inevitable that there must be an intimate connection between faulty methods of agriculture and animal disease.

In crops like potatoes and fruit, the use of the poison spray has closely followed the reduction in the supplies of farm-yard manure and the diminution of fertility.

Food preservation processes are also on the increase. A feature of the agriculture of the West is the development of food preservation

processes by which the journey of products like meat, milk, vegetables, and fruit between the soil and the stomach is prolonged. This is done by freezing, by the use of carbon dioxide, by drying, and by canning. Although food is preserved for a time in this way, what is the effect of these processes on the health of the community during a period of, say, twenty-five years? Is it possible to preserve the first freshness of food? If so then science will have made a very real contribution.

Science has been called in to help production. Another of the features of the agriculture of the West is the development of agricultural science. Efforts have been made to enlist the help of a number of separate sciences in studying the problems of agriculture and in increasing the production of the soil. This has entailed the foundation of numerous experiment stations which every year pour out a large volume of advice in the shape of printed matter.

These mushroom ideas of agriculture are failing; mother earth deprived of her ***manurial rights*** *is in revolt; the land is going on strike; the fertility of the soil is declining.* An examination of the areas which feed the population and the machines of a country like Great Britain leaves no doubt that the soil is no longer able to stand the strain. Soil fertility is rapidly diminishing, particularly in the United States, Canada, Africa, Australia, and New Zealand. In Great Britain itself real farming has already been given up except on the best lands.

The loss of fertility all over the world is indicated by the growing menace of soil erosion. The seriousness of the situation is proved by the attention now being paid to this matter in the press and by the various Administrations. In the United States, for example, the

whole resources of government are being mobilized to save what is left of the good earth.

The agricultural record has been briefly reviewed from the standpoint of soil fertility. The main characteristics of the various methods of agriculture have been summarized. The most significant of these are the operations of Nature as seen in the forest. There the fullest use is made of sunlight and rainfall in raising heavy crops of produce and at the same time not only maintaining fertility but actually building up large reserves of humus.

The peasants of China, who pay great attention to the return of all wastes to the land, come nearest to the ideal set by Nature. They have maintained a large population on the land without any falling off in fertility.

The agriculture of ancient Rome failed because it was unable to maintain the soil in a fertile condition. The farmers of the West are repeating the mistakes made by Imperial Rome. The soils of the Roman Empire, however, were only called upon to assuage the hunger of a relatively small population. The demands of the machine were then almost non-existent. In the West there are relatively more stomachs to fill while the growing hunger of the machine is an additional burden on the soil. The Roman Empire lasted for eleven centuries.

How long will the supremacy of the West endure? The answer depends on the wisdom and courage of the population in dealing with the things that matter. Can mankind regulate its affairs so that its chief possession—the fertility of the soil—is preserved? On the answer to this question the future of civilization depends.

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15.

Death Of Soil

A Result Of The Policy Failure

By Sir Albert Howard, 1940

Perhaps the most widespread and the most important disease of the soil at the present time is soil erosion, a phase of infertility to which great attention is now being paid. Soil erosion in the very mild form of denudation has been in operation since the beginning of time. It is one of the normal operations of Nature going on everywhere. The minute soil particles which result from the decay of rocks find their way sooner or later to the ocean, but many may linger on the way, often for centuries, in the form of one of the constituents of fertile fields.

This phenomenon can be observed in any river valley. The fringes of the catchment area are frequently uncultivated hills through the thin soils of which the underlying rocks protrude. These are constantly weathered and in the process yield a continuous supply of minute fragments in all stages of decomposition.

The slow rotting of exposed rock surfaces is only one of the forms of decay. The covering of soil is no protection to the underlying strata but rather the reverse, because the soil water, containing carbon dioxide in solution is constantly disintegrating the parent rock, first producing sub-soil and then actual soil. At the same time the remains of plants and animals are converted into humus. The fine soil particles of mineral origin, often mixed with fragments of

humus, are then gradually removed by rain, wind, snow, or ice to lower regions. Ultimately the rich valley lands are reached where the accumulations may be many feet in thickness.

One of the main duties of the streams and rivers, which drain the valley, is to transport these soil particles into the sea where fresh land can be laid down. The process looked at as a whole is nothing more than Nature's method of the rotation, not of the crop, but of the soil itself.

When the time comes for the new land to be enclosed and brought into cultivation agriculture is born again. Such operations are well seen in England in Holbeach marsh and similar areas round the Wash. From the time of the Romans to the present day, new areas of fertile soil, which now fetch £100 an acre or even more, have been re-created from the uplands by the Welland, the Nen, and the Ouse. All this fertile land, perhaps the most valuable in England, is the result of two of the most widespread processes in Nature— weathering and denudation.

It is when the tempo of denudation is vastly accelerated by human agencies that a perfectly harmless natural process becomes transformed into a definite disease of the soil. The condition known as soil erosion—a man-made disease—is then established. It is, however, always preceded by infertility: the inefficient, overworked, dying soil is at once removed by the operations of Nature and hustled towards the ocean, so that new land can be created and the rugged individualists—the bandits of agriculture—whose cursed thirst for profit is at the root of the mischief can be given a second chance.

Nature is anxious to make a new and better start and naturally has no patience with the inefficient. Perhaps when the time comes for a new essay in farming, mankind will have learnt a great lesson—how to subordinate the profit motive to the sacred duty of handing over unimpaired to the next generation the heritage of a fertile soil. *Soil erosion is nothing less than the outward and visible sign of the complete failure of a policy.* The causes of this failure are to be found in ourselves.

The damage already done by soil erosion all over the world looked at in the mass is very great and is rapidly increasing. The regional contributions to this destruction, however, vary widely.

In some areas like north-western Europe, where most of the agricultural land is under a permanent or temporary cover crop (in the shape of grass or leys), and there is still a large area of woodland and forest, soil erosion is a minor factor in agriculture.

In other regions like parts of North America, Africa, Australia, and the countries bordering the Mediterranean, where extensive deforestation has been practised and where almost uninterrupted cultivation has been the rule, large tracts of land once fertile have been almost completely destroyed.

USA - Conservation As A National Agenda

The United States of America is perhaps the only country where anything in the nature of an accurate estimate of the damage done by erosion has been made. Theodore Roosevelt first warned the country as to its national importance. Then came the Great War with its high prices, which encouraged the wasteful exploitation of soil fertility on an unprecedented scale. A period of financial depression, a series of droughts and dust-storms, emphasized the urgency of the salvage of agriculture.

During Franklin Roosevelt's Presidency, soil conservation has become a political and social problem of the first importance. In 1937 the condition and needs of the agricultural land of the U.S.A. were appraised. No less than 253,000,000 acres, or 61 per cent. of the total area under crops, had either been completely or partly destroyed or had lost most of its fertility. Only 161,000,000 acres, or 39 percent of the cultivated area, could be safely farmed by present methods.

In less than a century the United States has therefore lost nearly three-fifths of its agricultural capital. If the whole of the potential resources of the country could be utilized and the best possible practices introduced everywhere, about 447,466,000 acres could be brought into use—an area somewhat greater than the present crop land area of 415,334,931 acres. The position therefore is not

hopeless. It will, however, be very difficult, very expensive, and very time consuming to restore the vast areas of eroded land even if money is no object and large amounts of manure are used and green-manure crops are ploughed under.

The root of this soil erosion trouble in the United States is misuse of the land. The causes of this misuse include lack of individual knowledge of soil fertility on the part of the pioneers and their descendants; the traditional attitude which regarded the land as a source of profit; defects in farming systems, in tenancy, and finance—most mortgages contain no provisions for the maintenance of fertility; instability of agricultural production (as carried out by millions of individuals), prices and income in contrast to industrial production carried on by a few large corporations.

The need for maintaining a correct relation between industrial and agricultural production so that both can develop in full swing on the basis of abundance has only recently been understood. The country was so vast, its agricultural resources were so immense, that the profit seekers could operate undisturbed until soil fertility—the country's capital—began to vanish at an alarming rate.

The present position, although disquieting, is not impossible. The resources of the Government are being called up to put the land in order. The magnitude of the effort, the mobilization of all available knowledge, the practical steps that are being taken to save what is left of the soil of the country and to help Nature to repair the damage already done are graphically set out in *Soils and Men*, the Year Book of the United States Department of Agriculture of 1938. This is perhaps the best local account of soil erosion which has yet appeared.

Africa

The rapid agricultural development of Africa was soon followed by soil erosion. In South Africa, a pastoral country, some of the best grazing areas are already semi-desert. The Orange Free State in 1879 was covered with rich grass, interspersed with reedy pools, where now only useless gullies are found. Towards the end of the

nineteenth century it began to be realized all over South Africa that serious over-stocking was taking place.

In 1928 the Drought Investigation Commission reported that soil erosion was extending rapidly over many parts of the Union, and that the eroded material was silting up reservoirs and rivers and causing a marked decrease in the underground water-supplies. The cause of erosion was considered to be the reduction of vegetal cover brought about by incorrect veld management—the concentration of stock in kraals, over-stocking, and indiscriminate burning to obtain fresh autumn or winter grazing.

In Basutoland, a normally well-watered country, soil erosion is now the most immediately pressing administrative problem. The pressure of population has brought large areas under the plough and has intensified over-stocking on the remaining pasture.

In Kenya the soil erosion problem has become serious during the last three years, both in the native reserves and in the European areas. In the former, wealth depends on the possession of large flocks and herds; barter is carried on in terms of live stock; the bride price is almost universally paid in animals; numbers rather than quality are the rule.

The natural consequence is over-stocking, over-grazing, and the destruction of the natural covering of the soil. Soil erosion is the inevitable result. In the European areas erosion is caused by long and continuous overcropping without the adoption of measures to prevent the loss of soil and to maintain the humus content. Locusts have of late been responsible for greatly accelerated erosion; examples are to be seen where the combined effect of locusts and goats has resulted in the loss of a foot of surface soil in a single rainy season.

The countries bordering the Mediterranean provide striking examples of soil erosion, accompanied by the formation of deserts

which are considered to be due to one main cause—the slow and continuous deforestation. Originally well wooded, no forests are to be found in the Mediterranean region proper. Most of the original soil has been washed away by the sudden winter torrents.

In North Africa the fertile cornfields, which existed in Roman times, are now desert. Ferrari in his book on woods and pastures refers to the changes in the soil and climate of Persia after its numerous and majestic parks were destroyed; the soil was transformed into sand; the climate became arid and suffocating; springs first decreased and then disappeared.

Similar changes took place in Egypt when the forests were devastated; a decrease in rainfall and in soil fertility was accompanied by loss of uniformity in the climate. Palestine was once covered with valuable forests and fertile pastures and possessed a cool and moderate climate; to-day its mountains are denuded, its rivers are almost dry, and crop production is reduced to a minimum.

The above examples indicate the wide extent of soil erosion, the very serious damage that is being done, and the fundamental cause of the trouble—misuse of the land. In dealing with the remedies which have been suggested and which are now being tried out, it is essential to envisage the real nature of the problem. It is nothing less than the repair of Nature's drainage system—the river—and of Nature's method of providing the country-side with a regular water-supply. The catchment area of the river is the natural unit in erosion control. In devising this control we must restore the efficiency of the catchment area as a drain and also as a natural storage of water. Once this is accomplished we shall hear very little about soil erosion.

Japan - Preventing A National Disaster

Japan provides perhaps the best example of the control of soil erosion in a country with torrential rains, highly erodible soils, and a topography which renders the retention of the soil on steep slopes very difficult. Here erosion has been effectively held in check, by methods adopted regardless of cost, for the reason that the alternative to their execution would be national disaster.

The great danger from soil erosion in Japan is the deposition of soil debris from the steep mountain slopes on the rice-fields below. The texture of the rice soils must be maintained so that the fields will hold water and allow of the minimum of through drainage.

If such areas became covered with a deep layer of permeable soil, brought down by erosion from the hill-sides, they would no longer hold water, and rice cultivation—the mainstay of Japan's food-supply—would be out of the question.

For this reason the country has spent as much as ten times the capital value of eroding land on soil conservation work, mainly as an insurance for saving the valuable rice lands below. Thus in 1925 the Tokyo Forestry Board spent 453 yen (£45) per acre in anti-erosion measures on a forest area, valued at 40 yen per acre, in order to save rice-fields lower down valued at 240 to 300 yen per acre.

The dangers from erosion have been recognized in Japan for centuries and an exemplary technique has been developed for preventing them. It is now a definite part of national policy to maintain the upper regions of each catchment area under forest, as the most economical and effective method of controlling flood waters and insuring the production of rice in the valleys. For many years erosion control measures have formed an important item in the national budget.

According to Lowdermilk, erosion control in Japan is like a game of chess. The forest engineer, after studying his eroding valley, makes his first move, locating and building one or more check dams. He waits to see what Nature's response is.

This determines the forest engineer's next move, which may be another dam or two, an increase in the former dam, or the construction of side retaining walls. After another pause for observation, the next move is made and so on until erosion is checkmated.

The operation of natural forces, such as sedimentation and re-vegetation, are guided and used to the best advantage to keep down costs and to obtain practical results. No more is attempted than Nature has already done in the region. By 1929 nearly 2,000,000

hectares of protection forests were used in erosion control. These forest areas do more than control erosion. They help the soil to absorb and maintain large volumes of rain-water and to release it slowly to the rivers and springs.

China - Callous Approach

China, on the other hand, presents a very striking example of the evils which result from the inability of the administration to deal with the whole of a great drainage unit. On the slopes of the upper reaches of the Yellow River extensive soil erosion is constantly going on.

Every year the river transports over 2,000 million tons of soil, sufficient to raise an area of 400 square miles by 5 feet. This is provided by the easily erodible loess soils of the upper reaches of the catchment area. The mud is deposited in the river bed lower down so that the embankments which contain the stream have constantly to be raised.

Periodically the great river wins in this unequal contest and destructive inundations result. The labour expended on the embankments is lost because the nature of the erosion problem as a whole has not been grasped, and the area drained by the Yellow River has not been studied and dealt with as a single organism.

The difficulty now is the over-population of the upper reaches of the catchment area, which prevents afforestation and laying down of grass. Had the Chinese maintained effective control of the upper reaches—the real cause of the trouble—the erosion problem in all probability would have been solved long ago at a lesser cost in labour than that which has been devoted to the embankment of the river.

China, unfortunately, does not stand alone in this matter. A number of other rivers, like the Mississippi, are suffering from overwork, followed by periodical floods as the result of the growth of soil erosion in the upper reaches.

Although the damage done by uncontrolled erosion all over the world is very great, and the case for action needs no argument, nevertheless there is one factor on the credit side which has been overlooked in the recent literature. A considerable amount of new

soil is being constantly produced by natural weathering agencies from the sub-soil and the parent rock. This when suitably conserved will soon re-create large stretches of valuable land.

One of the best regions for the study of this question is the black cotton soil of Central India, which overlies the basalt. Here, although erosion is continuous, the soil does not often disappear altogether, for the reason that as the upper layers are removed by rain, fresh soil is reformed from below.

The large amount of earth so produced is well seen in the Gwalior State, where the late Ruler employed an irrigation officer, lent by the Government of India, to construct a number of embankments, each furnished with spillways, across many of the valleys, which had suffered so badly by uncontrolled rain-wash in the past that they appeared to have no soil at all, the scrub vegetation just managing to survive in the crevices of the bare rock. How great is the annual formation of new soil, even in such unpromising circumstances, must be seen to be believed.

In a very few years, the construction of embankments was followed by stretches of fertile land which soon carried fine crops of wheat. A brief illustrated account of the work done by the late Maharaja of Gwalior would be of great value at the moment for introducing a much needed note of optimism in the consideration of this soil erosion problem.

Why is the forest such an effective agent in the prevention of soil erosion and in feeding the springs and rivers? The forest does two things: (1) the trees and undergrowth break up the rainfall into fine spray and the litter on the ground protects the soil from erosion; (2) the residues of the trees and animal life met with in all woodlands are converted into humus, which is then absorbed by the soil underneath, increasing its porosity and water-holding power.

The soil cover and the soil humus together prevent erosion and at the same time store large volumes of water. These factors—soil protection, soil porosity, and water retention—conferred by the living forest cover, provide the key to the solution of the soil erosion problem.

All other purely mechanical remedies such as terracing and drainage are secondary matters, although of course important in their proper place. The soil must have as much cover as possible; it must be well stocked with humus so that it can drink in and retain the rainfall. It follows, therefore, that in the absence of trees there must be a grass cover, some cover-crop, and ample provision for keeping up the supply of humus. Each field so provided suffers little or no erosion.

This confirms the view of Williams (Timiriasev Academy, Moscow) who, before erosion became important in the Soviet Union, advanced an hypothesis that *the decay of past civilizations was due to a decline in soil fertility,* consequent on the destruction of the soil's crumb structure when the increasing demands of civilization necessitated the wholesale ploughing up of grass-land.

Williams regarded grass as the basis of all agricultural land utilization and the soil's chief weapon against the plundering instincts of humanity. His views are exerting a marked influence on soil conservation policy in the U.S.S.R. and indeed apply to many other countries.

Grass is a valuable factor in the correct design and construction of surface drains. Whenever possible these should be wide, very shallow, and completely grassed over. The run-off then drains away as a thin sheet of clear water, leaving all the soil particles behind.

The grass is thereby automatically manured and yields abundant fodder. This simple device was put into practice at the Shahjahanpur Sugar Experiment Station in India. The earth service roads and paths were excavated so that the level was a few inches below that of the cultivated area. They were then grassed over, becoming very effective drains in the rainy season, Carrying off the excess rainfalls clear water without any loss of soil.

If we regard erosion as the natural consequence of improper methods of agriculture, and the catchment area of the river as the natural unit for the application of soil conservation methods, the various remedies available fall into their proper place.

The upper reaches of each river system must be afforested; cover crops including grass and leys must be used to protect the arable surface whenever possible; the humus content of the soil must be increased and the crumb structure restored so that each field can drink in its own rainfall; over-stocking and over-grazing must be prevented; simple mechanical methods for conserving the soil and regulating the run-off, like terracing, contour cultivation and contour drains, must be utilized.

There is, of course, no single anti-erosion device which can be universally adopted. The problem must, in the nature of things, be a local one. Nevertheless, certain guiding principles exist which apply everywhere. First and foremost is the restoration and maintenance of soil fertility, so that each acre of the catchment area can do its duty by absorbing its share of the rainfall.

The Formation Of Alkali Lands

When the land is continuously deprived of oxygen the plant is soon unable to make use of it: a condition of permanent infertility results.

In many parts of the tropics and sub-tropics agriculture is interfered with by accumulations of soluble salts composed of various mixtures of the sulphate, chloride, and carbonate of sodium. Such areas are known as alkali lands.

When the alkali phase is still in the mild or incipient stage, crop production becomes difficult and care has to be taken to prevent matters from getting worse. When the condition is fully established, the soil dies; crop production is then out of the question. Alkali lands are common in Central Asia, India, Persia, Iraq, Egypt, North Africa, and the United States.

At one period it was supposed that alkali soils were the natural consequences of a light rainfall, insufficient to wash out of the land the salts which always form in it by progressive weathering of the rock powder of which all soils largely consist. Hence alkali lands were considered to be a natural feature of arid tracts, such as parts of north-west India, Iraq, and northern Africa, where the rainfall is very small.

Such ideas on the origin and occurrence of alkali lands do not correspond with the facts and are quite misleading. The rainfall of the Province of Oudh, in India, for example, where large stretches of alkali lands naturally occur, is certainly adequate to dissolve the comparatively small quantities of soluble salts found in these infertile areas, if their removal were a question of sufficient water only.

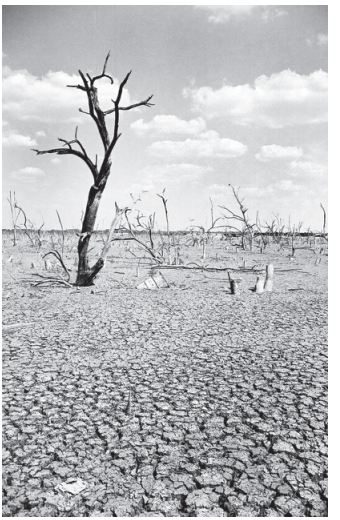
In North Bihar the average rainfall, in the sub-montane tracts where large alkali patches are common, is about 50 to 60 inches a year. Arid conditions, therefore, are not essential for the production of alkali soils; heavy rainfall does not always remove them. What is a necessary condition is impermeability.

In India whenever the land loses its porosity, by the constant surface irrigation of stiff soils with a tendency to impermeability, by the accumulation of stagnant subsoil water, or through some interference with the surface drainage, alkali salts sooner or later appear. Almost any agency, even over-cultivation and overstimulation by means of artificial manures, both of which oxidize the organic matter and slowly destroy the crumb structure, will produce alkali land.

In the neighbourhood of Pusa in North Bihar, old roads and the sites of bamboo clumps and of certain trees such as the tamarind (Tamarindus indica L.) and the pipul (Ficus religiosa L.), always give rise to alkali patches when they are brought into cultivation. The densely packed soil of such areas invariably shows the bluish-green markings which are associated with the activities of those soil organisms which live in badly aerated soils without a supply of free oxygen. A few inches below the alkali patches, which occur on the stiff loess soils of the Quetta Valley, similar bluish-green and brown markings always occur.

In the alkali zone in North Bihar, wells have always to be left open to the air, otherwise the water is contaminated by sulphuretted hydrogen, thereby indicating a well-marked reductive phase in the deeper layers. In a sub-soil drainage experiment on the black soils of the Nira valley in Bombay where perennial irrigation was followed

by the formation of alkali land, Mann and Tamhane found that the salt water which ran out of these drains soon smelt strongly of sulphuretted hydrogen, and a white deposit of sulphur was formed at the mouth of each drain, proving how strong were the reducing actions in this soil.



Here the reductive phase in alkali formation was unconsciously demonstrated in an area where alkali salts were unknown until the land was water-logged by overirrigation and the oxygen-supply of the soil was restricted.

The view that the origin of alkali land is bound up with defective soil aeration is supported by the recent work on the origin of saltwater lakes in Siberia. In Lake Szira-Kul, between Bateni and the mountain range of Kizill Kaya, Ossendowski observed in the black ooze taken from the bottom of the lake and in the water a certain distance from the surface an immense network of colonies of sulphur bacilli which gave off large quantities of sulphuretted hydrogen and so destroyed practically all the fish in this lake.

The great water basins in Central Asia are being metamorphosed in a similar way into useless reservoirs of salt water, smelling strongly of hydrogen sulphide. In the limans near Odessa and in portions of the Black Sea, a similar process is taking place.

The fish, sensing the change, are slowly leaving this sea as the layers of water, poisoned by sulphuretted hydrogen, are gradually rising towards the surface. The death of the lakes scattered over the immense plains of Asia and the destruction of the impermeable soils of this continent from alkali salt formation are both due to the same primary cause— intense oxygen starvation. Often this oxygen starvation occurs naturally; in other cases it follows perennial irrigation.

The stages in the development of the alkali condition are somewhat as follows. The first condition is an impermeable soil. Such soils—the usar plains of northern India for example—occur naturally where the climatic conditions favour those biological and physical factors which destroy the soil structure by disintegrating the compound particles into their ultimate units. These latter are so extremely minute and so uniform in size that they form with water a mixture possessing some of the properties of colloids which, when dry, pack into a hard dry mass, practically impermeable to water and very difficult to break up.

Such soils are very old. They have always been impermeable and have never come into cultivation. In addition to the alkali tracts which occur naturally a number are in course of formation as the result of errors in soil management, the chief of which are:

(a) The excessive use of irrigation water. This gradually destroys the binding power of the organic cementing matter which glues the soil particles together, and displaces the soil air. Anaerobic changes, indicated by blue and brownish markings, first occur in the lower layers and finally lead to the death of the soil.

It is this slow destruction of the living soil that must be prevented if the existing schemes of perennial irrigation are to survive. The process is taking place before our eyes to-day in the Canal Colonies of India where irrigation is loosely controlled.

(b) Over-cultivation without due attention to the replenishment of humus. In those continental areas like the Indo-Gangetic plain, where the risk of alkali is greatest, the normal soils contain only a small reserve of humus, because the biological processes which consume organic matter are very intense at certain seasons due to sudden changes from low to very high temperatures and from intensely dry weather to periods of moist tropical conditions.

Accumulations of organic matter such as occur in temperate zones are impossible. There is, therefore, a very small margin of safety.

The *slightest errors in soil management* will not only destroy the small reserve of humus in the soil but also the organic cement on which the compound soil particles and the crumb structure depend.

The result is impermeability, the first stage in the formation of alkali salts.

(c) The use of artificial manures, particularly sulphate of ammonia. The presence of additional combined nitrogen in an easily assimilable form stimulates the growth of fungi and other organisms which, in the search for the organic matter needed for energy and for building up microbial tissue, use up first the reserve of soil humus and then the more resistant organic matter which cements the soil particles.

Ordinarily this glue is not affected by the processes going on in a normally cultivated soil, but it cannot withstand the same processes when stimulated by dressings of artificial manures.

Alkali land therefore starts with a soil in which the oxygen supply is permanently cut off. Matters then go from bad to worse very rapidly. All the oxidation factors which are essential for maintaining a healthy soil cease. A new soil flora—composed of anaerobic organisms which obtain their oxygen from the substratum—is established.

A reduction phase ensues. The easiest source of oxygen—the nitrates—is soon exhausted. The organic matter then undergoes anaerobic fermentation. Sulphuretted hydrogen is produced as the soil dies, just as in the lakes of Central Asia. The final result of the chemical changes that take place is the accumulation of the soluble salts of alkali land—the sulphate, chloride, and carbonate of sodium.

When these salts are present in injurious amounts they appear on the surface in the form of snowwhite and brownish-black incrustations. The former (white alkali) consists largely of the sulphate and chloride of sodium, and the latter (the dreaded black alkali) contains sodium carbonate in addition and owes its dark colour to the fact that this salt is able to dissolve the organic matter in the soil and produce physical conditions which render drainage impossible.

According to Hilgard, sodium carbonate is formed from the sulphate and chloride in the presence of carbon dioxide and water. The action is reversed in the presence of oxygen. Subsequent investigations have modified this view and have shown that the formation of sodium carbonate in soil takes place in stages. The appearance of this salt always marks the end of the chapter. The soil is dead.

Reclamation then becomes difficult on account of the physical conditions set up by these alkali salts and the dissolved organic matter.

The occurrence of alkali land, as would be expected from its origin, is extremely irregular. When ordinary alluvial soils like those of the Punjab and Sind are brought under perennial irrigation, small patches of alkali first appear where the soil is heavy; on stiffer areas the patches are large and tend to run together. On open permeable stretches, on the other hand, there is no alkali.

In tracts like the Western Districts of the United Provinces, where irrigation has been the rule for a long period, zones of well-aerated land carrying fine irrigated crops occur alongside the barren alkali tracts.

Iraq also furnishes interesting examples of the connection between alkali and poor soil aeration. Intensive cultivation under irrigation is only met with in that country where the soils are permeable and the natural drainage is good. Where the drainage and aeration are poor, the alkali condition at once becomes acute.

There are, of course, a number of irrigation schemes, such as the staircase cultivation of the Hunzas in northwest India and of Peru, where the land has been continually watered from time immemorial without any development of alkali salts. In Italy and Switzerland

perennial irrigation has been practised for long periods without harm to the soil.

In all such cases, however, careful attention has been paid to drainage and aeration and to the maintenance of humus; the soil processes have been confined by Nature or by man to the oxidative phase; the cement of the compound particles has been protected by keeping up a sufficiency of organic matter. Every possible gradation in alkali land is met with.

Minute quantities of alkali salts in the soil have no injurious effect on crops or on the soil organisms. It is only when the proportion increases beyond a certain limit that they first interfere with growth and finally prevent it altogether. Leguminous crops are particularly sensitive to alkali especially when this contains carbonate of soda.

The action of alkali salts on the plant is a physical one and depends on the osmotic pressure of solutions, which increases with the amount of the dissolved substance. For water to pass readily from the soil into the roots of plants, the osmotic pressure of the cells of the root must be considerably greater than that of the soil solution outside. If the soil solution became stronger than that of the cells, water would pass backwards from the roots to the soil and the crops would dry up.

This state of affairs naturally occurs when the soil becomes charged with alkali salts beyond a certain point. The crops are then unable to take up water and death results. The roots behave like a plump strawberry when placed in a strong solution of sugar.

Like the strawberry they shrink in size because they have lost water to the stronger solution outside. Too much salt in the water therefore makes irrigation water useless and destroys the canal as a commercial proposition.

The reaction of the crop to the first stages in alkali production is interesting. For twenty years at Pusa and eight years in the Quetta Valley I had to farm land, some of which hovered, as it were, on the verge of alkali.

The first indication of the condition is a darkening of the foilage and the slowing down of growth. Attention to soil aeration, to

the supply of organic matter, and to the use of deeprooting crops like lucerne and pigeon pea, which break up the subsoil, soon sets matters right.

Disregard of Nature's danger signals, however, leads to trouble—a definite alkali patch is formed. When cotton is grown under canal irrigation on the alluvial soils of the Punjab, the reaction of the plant to incipient alkali is first shown by the failure to set seed, on account of the fact that the anther, the most sensitive portion of the flower, fails to function and to liberate its pollen. The cotton plant naturally finds it difficult to obtain from mild alkali soil all the water it needs—this shortage is instantly reflected in the breakdown of the floral mechanism.

The theory of the reclamation of alkali land is very simple. All that is needed, after treating the soil with sufficient gypsum (which transforms the sodium clays into calcium clays), is to wash out the soluble salts, to add organic matter, and then to farm the land properly.

Such reclaimed soils are then exceedingly fertile and remain so. If sufficient water is available it is sometimes possible to reclaim alkali soils by washing only. I once confirmed this. The berm of a raised water channel at the Quetta Experiment Station was faced with rather heavy soil from an alkali patch. The constant passage of the irrigation water down the water channel soon removed the alkali salts. This soil then produced some of the heaviest crops of grass I have ever seen in the tropics.

When, however, the attempt is made to reclaim alkali areas on a field scale, by flooding and draining, difficulties at once arise unless steps are taken first to replace all the sodium in the soil complex by calcium and then to prevent the further formation of sodium clays.

Even when these reclamation methods succeed, the cost is always considerable; it soon becomes prohibitive; the game is not worth the candle. The removal of the alkali salts is only the first step; large quantities of organic matter are then needed; adequate soil aeration must be provided; the greatest care must be taken to

preserve these reclaimed soils and to see that no reversion to the alkali condition occurs.

It is exceedingly easy under canal irrigation to create alkali salts on certain areas. It is exceedingly difficult to reverse the process and to transform alkali land back again into a fertile soil.

Nature has provided, in the shape of alkali salts, a very effective censorship for all schemes of perennial irrigation. The conquest of the desert, by means of the canal, by no means depends on the mere provision of water and arrangements for the periodical flooding of the surface. This is only one of the factors of the problem. The water must be used in such a manner and the soil management must be such that the fertility of the soil is maintained intact.

There is obviously no point in creating, at vast expense, a Canal Colony and producing crops for a generation or two, followed by a desert of alkali land. Such an achievement merely provides another example of agricultural banditry. It must always be remembered that the ancient irrigators never developed any efficient method of perennial irrigation, but were content with the basin system, a device by which irrigation and soil aeration can be combined. This system works like this: The land is embanked; watered once; when dry enough it is cultivated and sown. In this way water can be provided without any interference with soil aeration.

In his studies on irrigation and drainage, King concludes an interesting discussion of this question in the following words, which deserve the fullest consideration on the part of the irrigation authorities all over the world:

'It is a noteworthy fact that the excessive development of alkalis in India, as well as in Egypt and California, is the result of irrigation practices modern in their origin and modes and instituted by people lacking in the traditions of the ancient irrigators, who had worked these same lands thousands of years before. The alkali lands of today, in their intense form, are of modern origin, due to practices which are evidently inadmissible, and which in all probability were known to be so by the people whom our modern civilization has supplanted.'

Source

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16.

What Romans Could Teach Us

About Soils And Climate Change

By Tom Hodgkinson

What have the Romans ever done for us? Well, they did at least try to warn us that intensive farming would render our soils and civilisation unviable.

I've been reading the old Roman husbandry writers like Columella and Cato. It's fascinating to note that the Romans, in the later period, had very similar problems to us today, in that they fretted about the depletion of the soil and climate change. Columella, who was a native of Cadiz in Southern Spain, then a Roman colony, wrote his books, very roughly speaking, in the years 50-70 AD, nearly 2,000 years ago. His De Re Rustica (On Agriculture), opens with the following comments:

> Again and again I hear leading men of our state condemning now the unfruitfulness of the soil, now the inclemency of the climate for some seasons past, as harmful to crops; and some I hear reconciling the aforesaid complaints, as if on well-founded reasoning, on the ground that, in their opinion, the soil was worn out and exhausted by overproduction of earlier days and can no longer furnish sustenance.

Columella argues that mother earth does not in actual fact become exhausted. It is really a problem of bad stewardship:

> For the matter of husbandry, which all the best of our ancestors had treated with the best of care, we have delivered over to all the worst of our slaves, as if to a hangman for punishment.

Then as now, farms had become enormous factories, with up to 80,000 slaves producing food for the Empire. Elegant Romans had removed themselves from the soil and actually looked down on farming and farmers. This was not the case, says Columella, in the old days, when keeping a smallholding was a noble pursuit:

> We think it beneath us to till our lands with our own hands... but it was a matter of pride with our forefathers to give their attention to farming, from which pursuit came Quinctius Cincinnatus [in 458 BC], summoned from the plough to the dictatorship to be the deliverer of a beleaguered consul and his army, and then, again laying down the power which he relinquished after victory more hastily than he had assumed it for command, to return to the same bullocks and his small ancestral inheritance of four iugera [one iugera was about three fifths of an acre].

Columella also mentions a Roman obesity problem, linked to lazy lifestyles, and criticises, rather like an outraged tabloid newspaper, an over-indulgence in 'drunkenness' and 'gaming':

> The consequence is that ill health attends so slothful a manner of living; for the bodies of our young men are so flabby and enervated that death seems likely to make no change to them.

So Columella, rather like Cobbett in the 19th century, John Seymour in the 20th, and Hugh Fearnley-Whittingstall in our own, sees that the answer to our agricultural problems is to return dignity to the art of husbandry and encourage more people to till the land. We should be doing something useful he says, and we make the mistake of 'plying our hands [ie clapping] in the circuses and theatres rather than in the grainfields and vineyards'.

To this end he wrote twelve books of farming and gardening advice, including many suggestions on how to improve the soil and keep it fertile. He also gives directions on how to look after bees, poultry, pigs, cattle and sheep. Columella's is a hopeful

message because it returns power to the people, unlike the limp and ultimately profitless strategy of trying to persuade a capitalist government to change people's ways by force and persuasion. What is astonishing really is how close Columella's advice is to what you might find in a contemporary book about organic gardening or Permaculture. Climate change is clearly nothing new:

> I have found many authorities now worthy of remembrance were convinced that with the long wasting of the ages, weather and climate undergo a change... that regions which formerly, because of the unremitting severity of winter, could not safeguard any shoot of the vine or the olive planted in them, now that the earlier coldness has abated and the weather is becoming more clement, produce oil harvests and the vintages of Bacchus in the greatest abudnance.

The Roman Empire was to last another four hundred years or so after Columella was writing. It would seem that the answer to soil exhaustion and climate change is the same as it has ever been: simply to get back to the land.

Source

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17.

Save Our Soils

Organic Matter In Soil

Best Defense Against Erosion And Water Shortages

Organic matter in soil can absorb and store much more water than can inorganic fractions. It acts like a sponge, taking up water and releasing it as required by plants. It also helps bind soil particles into larger aggregates, or crumbs. Soils with this kind of structure are very resistant to erosion. Conversely, nearly all soils containing little or no organic matter are very susceptible to erosion.

Besides absorbing water readily, a good cropland soil should be able to dry out or warm up quickly when the rain is over. It should hold enough moisture to supply the needs of a crop between rains, yet permit water to pass through the soil. A good soil will not stay too wet or too dry.

"A governmental policy which results in impoverishing the natural fertility of land, no matter by what particular name it is called must have an end. It is only a question of time when this truly spendthrift course, this abuse of the goodness of Providence, shall meet its inevitable punishment.

Down to this day, great cities have ever been the worst desolators of the earth. It is for this that they have been so frequently buried many feet beneath the rubbish of their idols of brick, stone, and mortar, to be exhumed in after ages. . . . Their inhabitants violated the laws of nature which govern the health of man and secure the enduring productiveness of the soil.

There are other, less obvious relationships between soil erosion and crop selection and management. Many soils can be planted with maize without much erosion risk if the maize crop is rotated with legumes and small grains. If maize is planted year after year, however, soil losses begin to mount.

Source

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18.

Save Our Soils

Importance Of Humus In Soil Preservation

And Role Of Farmyard Dung In Humus creation

Humus is a word that was invented before the days of Liebig to cover up a large number of complexities that could not be simplified, and the word remains because the situation also remains. We are still very much in the dark about the precise composition of humus and exactly why it is so important.

However, evidence that comes from observing effects must not be rated lower in value than evidence that can explain the effects. To take up again the analogy of the trial for murder; if a witness is produced who saw the accused stick a knife into the victim, that evidence—provided the witness is reliable—outweighs all the circumstantial evidence that tries to show why the accused had reason to commit the murder or how he had the opportunity and so on.

Humus is the dark brown or black decomposed organic matter invariably noticeable in what are called rich soils. Farmyard manure, stable manure, vegetable waste matter, these in their fresh forms are not humus but rather the raw materials that can be turned into humus.

Its Properties

By far the simplest way to interpret humus is to list the things it can do. Its properties—from the point of view of soil fertility—can be divided into three classes; mechanical or physical, biological, and chemical.

The physical or mechanical effects are as follows. It can bind together a light, crumbling soil; but it can also make a sticky, heavy soil more friable.

The erosion disasters in the United States, in which thousands of crop-producing acres became a desert or 'dust-bowl', are now generally admitted to have been caused by humus deficiency. The soils were originally very rich; they were farmed without attention to humus replacement—the top-soils became more and more friable, crumbled into dry dust; then, once a certain level in deterioration was reached, nothing could save the soils from being swept away by rough weather.

Humus keeps the soil particles apart and so keeps air moving through the soil. It holds water better than soil so that plants in a humus-rich soil are less affected by drought conditions.

Sir John Russell has reported that plots at Rothamsted regularly treated with farmyard manures contain 3 to 4 per cent more water than plots under similar cropping conditions but which receive non-humus containing manures. And, of course, every gardener knows how much better are his moisture-needing summer crops like beans, peas, tomatoes, marrows, etc., if rotted organic matter is trenched in underneath them.

'Humus is a natural body; it is a composite entity, just as are plant, animal, and microbial substances; it is even more complex chemically, since all these materials contribute to its formation.'

~ S. A. Waksman

A minor physical effect comes from its colour, for by tending to darken the soil it increases the absorption capacity of the soil for warm sun rays and thus can keep the soil temperature a little higher.

Its biological properties are vital. It increases the activities of so many organisms whose work is a favourable factor to soil fertility. From the earthworm to the invisible earth bacteria, the life of the soil population is stimulated by the presence of humus. This is an important matter that we shall have to consider in much more detail later—for the moment let it be left at that.

Chemically, humus—or at any rate the manures that contain humus—will contain supplies of the elements of plant-growth. This is obvious for the manures have been produced by the 'rotting' of plant material-—whether a cow has eaten, digested, and expelled grass or mangolds or whether waste green material has been directly composted in a heap.

At this preliminary and general stage, we need not go into the question of how much of the original minerals etc. taken from the soil by the plants will still remain in the humus type manures which are later put back into the soil; but clearly the manures will have some definite value of this kind.

Also, in this plant food department of soil fertility, humus plays an indirect role; for it can increase the soil's capacity for retaining soluble (and therefore active) kinds of these plant-foods. As we shall see later, there is always a tendency for immediate fertility in soils to be lost through the soil's inability to hold all its active plant-food supply indefinitely. So that the help of humus in compensating for this adverse factor is important.

Humus Creation

How can the humus content of the soil be kept up? By the digging or ploughing in of animal manures—farmyard, stable, or sewage manures. By composting all organic wastes. By the deliberate growing of what are called 'green manure' crops, e.g. mustard, for digging in.

And by the digging in of all crop wastes left after harvesting, e.g. stubble, mangold tops, and so on. When grassland is converted

to arable land, as has happened so widely in wartime, the turned-in turf provides valuable humus as it slowly rots down in the soil.

It will be noted that the application of fertilizers has not been given as a direct method of providing humus, but the application of bulky organic manures is. This is a fundamental distinction.

Larger crops mean bigger residues for ploughing-back, and also bigger root systems left in the soil to rot down into humus. The extent to which the below-ground parts of crops provide humus is much under-estimated. When a ley is ploughed in, we realize obviously enough that its green stem and foliage matter must make a big contribution to the soil's humus; but the thick mass of root systems underneath may well make an even bigger one.

Farmyard Manure Vs Fertilizer

The difference between farmyard manures and fertilizers is confused by the fact that the manures contain not only humus but also supplies of the fertility elements. In this latter sense, therefore, they overlap the function of fertilizers. We must neither exaggerate the value of this overlap, nor underestimate it.

Important questions affecting the whole argument about fertilizers are: (1) how much 'chemical' plant-food do these natural manures provide; (2) how much natural manure of all kinds is, or can be made, available; (3) how much plant-food must be added to the soil to maintain fertility at the level necessary for our requirements?

It is the chemical plant-foods with which fertilizers are more concerned. Liebig made the point that any element found by analysis

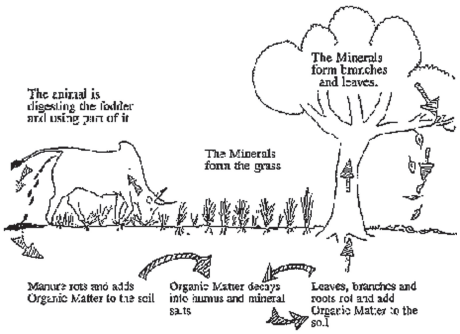
If your energy is all engaged in manufacturing tires and wheels, then who will go to the farm...So gradually farming will be reduced, and the city residents, they are satisfied if they can eat meat. And the farmer means keeping the, raising the cattle and killing them, send to the city, and they will think that "We are eating. What is the use of going to..." But these rascals have no brain that "If there is no food grain or grass, how these cattle will be...?" Actually it is happening. They are eating swiftly.

-Srila Prabhupada (Room Conversation with Dr. Theodore Kneupper — November 6, 1976, Vrndavana)

in the composition of a healthy plant was ipso facto an element necessary to its proper growth. (It is not so true in a quantitative sense, for an element that is present in large quantities in a plant may not be any more important than one present only in very much smaller quantities. The different elements have different functions. One element may function as a direct food; another may be needed only in traces in order to allow the plant to digest the first element.)

The elements found in plants generally are: carbon, nitrogen, hydrogen, oxygen, phosphorus, potassium, calcium, magnesium, sulphur, iron, manganese, chlorine, boron. Even this is not a complete list but it contains the main ones and some minor ones.

Now of these elements there are three important ones that the soil itself does not seem able to supply sufficiently for our cropping needs—nitrogen, phosphorus, and potassium. Each harvested crop takes away supplies of these elements that have come from the soil and, after a time, these losses reduce the soil's ability to go on feeding crops.



By sampling and analysis it is a simple matter for a chemist to measure just how much of these elements is removed, say, per acre by a crop.

Thus, a good crop of potatoes might take from the soil about 150 pounds of potash (oxide of potassium) per acre. What happens to

'The fixation of nitrogen is vital to the progress of civilized humanity, and unless we can class it among the certainties to come, the great Caucasian race will cease to be foremost in the world, and will be squeezed out of existence by the races to whom wheaten bread is not the staff of life.'

~ Sir William Crookes, 1898.

this 150 pounds? The potatoes are eaten, digested, expelled from the human system into the sewage system. In a modern city this usually means that the sewage is treated and then conducted into a river or sea as quietly and unobtrusively as possible. That part of the potash in the discarded peelings may go on to a compost heap

The aborigines were in fact far better at maintaining and conserving the central Australian landscapes, the central Australian arid regions, than any Australian since European colonization.

The aborigines lived in almost perfect harmony with their environment for thirty thousand years, thirty to forty thousand recorded years -- that's how far our research can take us back -- whereas in a little over a hundred years, European man in Australia has done in places irreparable damage to not only the vegetation but also the soils of arid Australia. It's damage that will probably never, ever be repaired because the environment is so delicate in central Australia that as soon as our cloven-footed animals, our sheep and our cattle, for example, are brought into the arid areas, they eat, they trample, they remove vegetation. This loosens the soil; the soil is very thin. It's very unfertile, and it blows away. And virtually all you have left is rock. And nothing grows, of course, on rock. That's an over-simplification and perhaps an over-dramatization, but this has happened in Australia. It didn't happen when the aborigines lived here, undisturbed by us. It has happened since European man has come.

In Perth, in this city, around this city, since Europeans have come, we have removed forests, we've cut down trees, we've tilled the soil, we have changed the natural order of things, we have increased the amount of water from rain that flows through the soil. It's getting more and more salty. We are affecting our coastal wetlands, as we call them, the lagoons and the lakes and the marshes, so that they are becoming both more salty and more clogged with silt and soil and debris. Water birds can, in some areas, no longer live there. Fish are dying. A lot of migratory fish and crabs, for example, are no longer migrating to their traditional breeding grounds.

We're stuck with that... Whether we like it or not, we're stuck with our urban civilization. We're stuck with our Western way of doing things, unfortunately. ~Justin Murphy, Geographer (Conversation with Srila Prabhupada, May 14, 1975, Perth)

or be fed to pigs or poultry in which case a fraction of the potash will eventually find its way back to the soil. But, in sewage disposal, most of the potash is lost completely.

Admitted, there is some sewage reclamation carried on, but it must be remembered that sewage in modern sanitation is heavily diluted with water and this means that the active plant-food—the kind that can dissolve in water-must pass into the liquid fraction of sewage. And it is this liquid fraction that is discarded in most systems—the sludges that are reclaimed at some works are composed of the solid, insoluble parts of sewage. There is, therefore, continuous loss. In less civilized countries—or perhaps it is fairer to say less industrialized countries— the sewage is disposed of by putting it directly back on to and into the soil.

In cattle farming, the nitrogen, phosphorus, and potash consumed when the cattle eat grass or fodder crops returns to the farm as manure. That is why the farmyard manures have been valued so much in traditional farming.

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19.

Save Our Soils

Earthworm - Our True Friend

Cattle Manure Is Earthworm Friendly And Chemical Fertilizers Destroy Them

By Donald P. Hopkins

When we come to the larger soil organisms, and in particular to the earthworm, the humus school stands in a stronger position. For the earthworm's contribution to soil fertility has been sadly neglected by modern soil science. Even in the United States where official research facilities in agriculture are so liberally supported, even there most of the modern work upon the earthworm has been left in private hands.

The scientific estimation of the earthworm's contribution begins with Charles Darwin. Over a number of years he observed worms' habits and the many kinds of soil changes they brought about, and in 1881 he published a monograph, The Formation of Vegetable Mould Through the Action of Worms with Observations on Their Habits.

`This exhaustive study was no ordinary record of a naturalist's investigation, otherwise there might be more excuse for the scanty

attention paid to it by contemporary and later science. Darwin was not content to present a 'purist' view of the worm—he went much beyond this and stressed the important consequences of worms' habits to the soil. But what should have been a classic in scientific literature caused practically no stir at all. Darwin's fame was to rest upon apes, not worms.

In 1945, however, and in no small measure due to the activity of the modern humus school, this book was republished under the neater title, Darwin on Humus and the Earthworm (Faber and Faber), with a preface by Sir Albert Howard. Not unnaturally Sir Albert tied up Darwin's neglected points with the humus school thesis. But before we inquire into this enrolment of Darwin as a

The charge that chemical fertilizers are a prime cause of unhealthy growth is shown by the following quotations:

'Diseases are on the increase. With the spread of artificials and the exhaustion of the original supplies of humus carried by every fertile soil, there has been a corresponding increase in the diseases of crops and animals which feed upon them.'

~Sir Albert Howard, An Agricultural Testament.

'My canes (raspberry) have not had any chemical fertilizers, and in consequence have not required spraying. In this, as in other cases, no chemicals means no sprays.'

~F. C. King, article in The Market Grower, 18.3.44.

'The accelerated growth induced by chemical fertilizers has the effect, among others, of speeding up the rate at which humus is exhausted. As this depletion of humus proceeded, troubles began. Parasites and diseases appeared in the crops, and epidemics became rife among our livestock, so that poison sprays and sera had to be introduced to control these conditions.'

~E. B. Balfour, The Living Soil.

'Now sulphate of ammonia and many other artificial manures are likely to kill the earthworm and bacterial life of the soil, and so one gets ill-nourished plants which are liable to fatal attack by disease and insect pests. Disease, fungus, and insect pests are always with us, but they chiefly affect the unhealthy plant.'

~Lord Lymington, Famine in England.

member of the humus school—or should it be as a distinguished past-president?—it is best to see what Darwin himself said.

Apart from a large number of brilliant deductions about the way worms live, Darwin proved that they eat raw and half-decayed organic matter and also pass through their bodies considerable quantities of earth. In this intermingling process they produce a rich vegetable mould or well-humified soil, and this is constantly being added to the upper surface of soils.

To quote the original monograph: 'Worms have played a more important part in the history of the world than most persons would at first suppose. In almost all humid countries they are extraordinarily numerous, and for their size possess great muscular power. In many parts of England a weight of more than ten tons of dry earth annually passes through their bodies and is brought to the surface of each acre of land; so that the whole superficial bed of vegetable mould passes through their bodies in the course of every few years. . . .'

And again: 'Worms prepare the ground in an excellent manner for the growth of fibrous-rooted plants and for seedlings of all kinds. They periodically expose the mould to the air, and sift it so that no stones larger than they can swallow are left in it. They mingle the whole together, like a gardener who prepares fine soil for his choicest plants.'

'In this state it is well fitted to retain moisture and to absorb all soluble substances, as well as for the process of nitrification. . . .'

As the figure of ten tons per year per acre may seem surprising, it might be as well to summarize the evidence upon which Darwin based this estimate. He was led to believe that the weight of soil normally brought to the surface by worms was fairly high from studying the rate at which large objects such as big stones or even old ruins were gradually buried in the land. He himself and one or two interested friends collected and weighed all the worm castings over timed periods on measured areas of land, on very small plots

of about one square yard or so. If the areas were indeed rather tiny, on the other hand the time period was long; but in any case the run of various results was reasonably consistent.

Darwin was able to check the reliability of these figures by approaching the same problem in a different way.

An American measurement, quoted by Sir Albert Howard, shows that the soil of the castings is very much richer than the corresponding soil.

The Cattle Compost Factory

The compost factory at Indore adjoins the cattle shed. This latter has been constructed for forty oxen and is provided with a cubicle, in which a supply of powdered urine earth can conveniently be stored. The cattle stand on earth. A paved floor is undesirable as the animals rest better, are more comfortable and are warmer on an earthen floor. The earth on which the cattle stand absorbs the urine, and is replaced by new earth to a depth of six inches every three or four months. The compost factory itself is a very simple arrangement. It consists of thirty-three pits, each 30 ft. by 14 ft. and 2 ft. deep with sloping sides, arranged in three rows with sufficient space between the lines of pits for the easy passage of loaded carts. The pits themselves are in pairs, with a space 12 ft. wide between each pair. This arrangement enables carts to be brought up to any particular pit. Ample access from the compost factory to the main roads is also necessary, so that during the carting of the compost to the fields, loaded and empty carts can easily pass one another, and also leave room for the standing carts which are being filled.

Manurial Value Of Indore Compost

One-cart load of Indore compost is equivalent, as regards nitrogen content, to two cart-loads of ordinary farmyard manure. Properly made compost has another great advantage over ordinary manure, namely its fine powdery character which enables it to be uniformly incorporated with the soil and to be rapidly converted into food materials for the crop. Taking everything into consideration, Indore compost has about three times the value of ordinary manure.

~ By Sir Albert Howard, (An Agricultural Testament)

The point that Darwin made verbally in 1881 is thus well and truly confirmed by these 1942 figures from Connecticut Experiment Station.

There may have been other similar measurements in the interim but, if so, little attention has been paid to them. 1881 to 1942 is a long time, and the humus school can well claim in this matter that 'official' research has largely ignored a known biological factor in soil fertility - earthworms.

With this point behind them the humus school has launched a strong attack at chemical fertilizers on the grounds that these materials discourage earthworms, drive them away and thus greatly diminish their powerful contributions. Where chemical fertilizers are used the earthworm populations are low or nil; additional supplies of chemical NPK are then needed to make up for the supplies from the soil's store that would otherwise have been made available by the worms.

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"When you're cooking with food as alive as this -- these gorgeous and semigorgeous fruits and leaves and grains -- you're in no danger of mistaking it for a commodity, or a fuel, or a collection of chemical nutrients. No, in the eye of the cook or the gardener ... this food reveals itself for what it is: no mere thing but a web of relationships among a great many living beings, some of them human, some not, but each of them dependent on each other, and all of them ultimately rooted in soil and nourished by sunlight."

~Michael Pollan

20.

Save Our Soils

Vital Role Of Cattle Manure In Maintaining Soil's Organic Matter

by William A. Albrecht, PhD

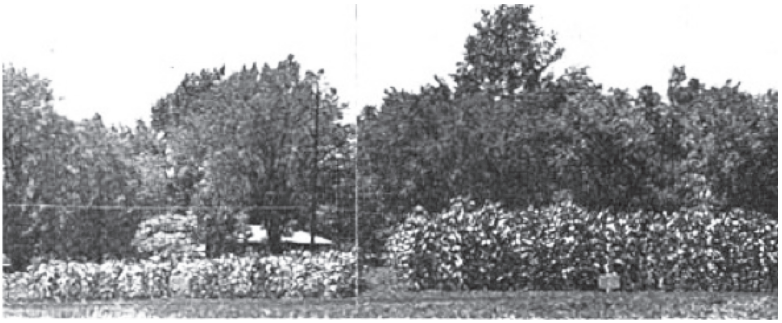
The use of "fossil" fuels in their various forms, like coal, kerosene, gasoline, and other volatile, readily combustible materials for agricultural power, to replace that of horses and mules, has brought about the highly exploitative attacks on the natural reserve organic matter of our surface soils.

This has resulted for two reasons: (a) more power and speed are applied to the tilling of the soil more deeply and vigorously to hasten the combustion of the reserves of microbial energy materials; (b) less organic matter is returned in the animal feed residues as manure, modified and improved as nutrition for the soil microbes and plants by the addition of the chemically more complex and varied waste products of the animal's physiology.

Reasons

The first of these reasons has been widely recognized as an unavoidable result of the high labor costs demanding such speed to raise the output per man.

The second reason has been generally disregarded. Manure handling has always been considered a distasteful sanitary chore incidental to keeping animals housed and penned, more than it



Striking Results . . . Farm manure (six tons per acre annually — right) demonstrated its effects (July, 1958) in the upkeep of soil productivity under corn continuously (69th successive crop) in contrast to that of the soil under similar cropping but no manure (left). The same noble hybrid seed on both plots didn't overcome the difference in the soils due to manure and no manure.

has been appreciated as an essential, biochemical contribution to the nutritional quality of feeds and foods grown on manured soil. Also, it simultaneously does much to maintain the organic matter in its fertilizing services.

Chemical studies were made of the soils after 67 years of (a) no cattle manure on one set of plots, and (b) six tons per acre annually on another. Each set in such contrasting pairs had been under cropping to (a) wheat, (b) corn, (c) timothy annually, and also to (d) a four-year rotation of corn, oats, wheat, and clover, and (e) a six-year rotation of corn, oats, wheat, clover and timothy. From these data, it is clearly evident how much the use of barnyard manure (cow dung) has contributed to help in the upkeep of the organic matter supply in those soils. (See the table).

Results

Under cropping to wheat continuously, the manured plot of soil had 2.4 percent of organic matter, when the unmanured one had only 2.1 percent. The former was three parts richer over 21 parts, or higher by one-seventh. Under corn continuously, the manure plot was higher in organic matter after the 67 years by four-sevenths. Under timothy sod continuously, the increase figure was nearly one-third; under the four year rotation, it was over one-third; and

Soil Composition--Due to Barnyard Manure after 67 Years. Sanborn Field, Columbia, Missouri

Crop	Treatment	Organic Matter %	Phosphoric Acid, lbs/A	Essential M.E. Ca	Cations Exchangeable Mg	Cations Exchangeable K	Cation Exchange Capacity M.E.	Hydrogen M.E.
Wheat	Manure	2.4	189	2140	306	348	16	8.5
Wheat	None	2.1	77	1900	360	312	16	9.5
Corn	Manure	2.2	202	3350	565	414	17	6.0
Corn	None	1.4	62	2600	462	239	15	8.0
Timothy	Manure	3.0	201	2650	216	273	15	4.9
Timothy	None	2.3	15	2100	140	144	15	4.8
4-year Rotation	Manure	2.7	151	3850	245	307	18	4.8
4-year Rotation	None	2.0	38	3230	245	307	18	4.8
6-year Rotation	Manure	2.5	94	2600	210	233	16	4.5
6-year Rotation	None	2.0	22	2866	108	113	16	4.6

in the six-year rotation, one-fourth, or next to the lowest, which was the soil under wheat. These were the effects from using manure when in all of these cases the entire crops had been removed and no crop residues were returned.

Help From Cattle Manure

As additional significance, there is the help from barnyard manure in the maintenance of the inorganic part of the soil fertility. This was shown by the ash analysis of the soil for phosphate (phosphoric acid, P2O5) and for some of the cationic essential elements, namely: calcium, Ca; magnesium, Mg; and potassium, K.

It is also significant to note the help from manure in keeping up the soil's exchange--absorption capacity (cation exchange capacity), in which the organic matter is more active than the clay. Also the lowered soil acidity resulting from the use of manure, as measured by the amount of exchangeable hydrogen, in the soil after 67 years, deserves attention as a modified soil condition not commonly appreciated in connection with this soil treatment.

Contrasting values in each of the above cases of the elements cited for manure and no manure (Table) show clearly that manure has fertility values we do not commonly emphasize.

Demonstration

After nearly three score and ten years of manuring, this treatment demonstrates that, in the matter of soil maintenance, cattle manure has values for:

(a) upkeep of the supply of reserve organic matter;

(b) holding up the soil's content of phosphorus even when manure is relatively low as a fertilizer for this essential element;

(c) preserving the supply of active potassium;

(d) maintaining the exchangeable magnesium;

(e) preserving the supply of active calcium; and

(f) helping to hold down the excessive concentration of acidity as hydrogen.

Manuring the soil has been doing these things for years under merely the belief in it as a good practice, and long before science gave us these few tabulations of what we can prove in favor of cattle manure. In the organic matter of the soil as part of the nutrition of microbes, plants, animals and man there is still much in the realm of good practice and much remains yet for science to prove and to explain.

Respect For Nature

The facts that have been outlined will be observed in nature by those who do not have preconceived ideas about plant growth. Unfortunately the professional agriculturalist often views the effects of soils on the plant's growth with a distant outlook, as if the only problems were those of industrial manipulation of dead materials, with emphasis on the various technologies for economic advantages only.

People who approach agricultural research in this way have lost sight of agriculture as a biological demonstration by the forces of nature, *where man is more spectator than manager in complete control of soil and produce.*

Such unrealistic views of agriculture have led to expressions and views by high government officials that soil is but a chemical and physical agent for the production of larger quantities of crops.

They seem unaware that the soil of our planet is a complex material developed through many centuries, having the power of creation, not only for plants, but for everything that lives, moves and has its being upon the earth.

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21.

Save Our Soils

The Importance Of Farmyard Dung

In The Beginning Days, Even Fertilizer Companies Admitted It

Donald P. Hopkins (Chemicals Humus, And The Soil)

It is often said that those who have chemicals to sell have harnessed science to their own interests rather than to the interests of the soil.

That is to say, they have paid chemists to concentrate upon the kinds of research that deal with the effects of chemicals whilst nobody else has been very ready or able to foot the bill for scientific inquiries in other directions. It is also often said that the advertising pressure of large chemical firms over-accentuates the favourable claims of chemicals, and this has in a long period led to an unbalanced fashion for chemicals even among scientists themselves.

A kind of fixed-idea-mentality has been built up. From my own contacts with people who directly live by the soil and its produce, I very much doubt whether there could be any kind of humanity less susceptible either to subtle or crude advertising.

Suspicion and scepticism go hand in hand with the plough and the harvester.

Here are extracts from pre-war literature issued for sales-purposes by one of the largest chemical companies and fertilizer manufacturers in Britain.

When writing the original edition of this book, I made a survey of the sales-literature this company had issued, though it was admittedly limited to the amount that still remained intact and could be gathered together during the war period. I was anxious to check whether charges of chemical bias, and in particular the advocating of using fertilizers to the exclusion of manures, could be substantiated. I found that on the contrary the complementary use of manure and fertilizers had often been strongly advised.

'The most successful potato growers manure their crops with dung and complete fertilizers.'

'Fertilizers will help to restore exhausted grasses to vigour, but cannot give their full effect unless the pasture is rested at the right time and is therefore in a fit condition to respond.'

'In every country where sugar beet is cultivated, it has been found both essential and profitable to manure the land well with dung and a complete fertilizer.'

'The best rule for the amateur to follow is to apply as much dung as he can get in order to improve the physical condition of his soil, and to make up for any lack of plant-food by the use of other organic and artificial fertilizers.'

The prosecution states that plants raised with chemicals are less robust, less able to withstand the attacks of fungi, pests, and viruses; so that epidemic ill health results. This being so, extra yields are short-term and illusory benefits, quantity and not quality, and quantity in any case that must be frequently discounted by severe loss.

The humus school have suggested why this happens, and we have already analysed some of their evidence for specific charges against chemicals in chapter eleven. But details hardly matter—a fact is still a fact whether it can be explained or not. And we should be able to decide whether the use of fertilizers has increased diseases and attacks by pests—it is the kind of thing that can be assessed reasonably well by observation and measurement; in the widest sense, indeed, by mass observation and statistics. ~ Donald P. Hopkins

'It is not possible to grow well-developed healthy plants with the aid of nitrogen exclusively, whether it be applied in the form of sulphate of ammonia or any other purely nitrogenous fertilizer . . . sulphate of ammonia should be used in conjunction with fertilizers supplying phosphates and potash. . . . Supplement your work of cultivation by conserving all the trimmings from your garden, all lawn mowings, hedge clippings, dead plants, and the like, in a compost heap.'

'Fertility depends on light and air; on methods of cultivation; on the presence in the soil of water; organic matter (humus); of bacteria; of nitrogen, phosphates, potash, calcium; and of small quantities of what are known as the minor elements. All these factors are interrelated so that all must be maintained at the right level if fertility is not to suffer.'

None of these quotations was printed in any lesser type than the type in the rest of the general statement. By way of history, here are extracts from a very old-established fertilizer manufacturers' guide for farmers issued as long ago as 1857.

'Judiciously applied, in agriculture, artificial manures meet the natural deficiency of valuable fertilizing constituents in farmyard manures, and when both kinds are used conjointly (which we always recommend when practicable) the value of dung is greatly enhanced.'

'And it should always be borne in mind that these (artificial) manures are intended to supply any deficiency in quantity or quality of farmyard dung, and not to supersede its use.'

A good deal of compost has been made on tea-estates in North India, where the necessary vegetable matter is easily collected from the uncultivated land near the estates. The collection of this material has, however, in places led to bad soil erosion.

'It is stated that the results are best when sufficient quantities of cattle or other animal manure are available; they are said to be less satisfactory where the animal manure has been deficient. Attempts to run tea estates on compost alone, however, proved unsatisfactory; it was necessary to provide the proper artificials where ever sufficient cattle manure was lacking.

~ Sir Albert Howard

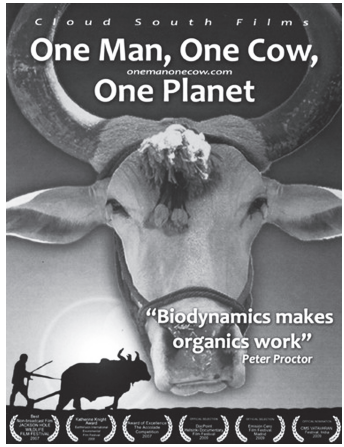
22.

Save Our Soils

One Old Man With A Bucket Of Cow Dung On A Mission To Save India's Soil

Can one man with a bucket of cow dung be a recipe to save the planet? No claim could be more preposterous and more insane. That is until you watch the international awards winning film, One Man One Cow One Planet!

This is the story of a New Zealander spearheading a silent revolution in some of the world's most destitute areas, all alone with a bucket of cow dung. This film is being claimed to be a blueprint for a post-industrial future. It takes you into the heart of the world's most important renaissance.



Hero of the film, Peter Proctar is an eighty year old gardener and soil expert from New Zealand. He comes with a vast experience of sixty years in his field.

His favourite animal is the cow because of all the dung she provides. Dung is something that Proctor prizes more highly than gold, jewels, fossil fuels, or many other natural resources. His favourite invertebrate is the earthworm, which he describes as "the unpaid servant of soil health."

In the film, his farm operates on human scale, and is self sustaining, ethical and biologically diverse. It is a blue print for future when fossil fuels will be scarce. World's most valuable commodity will be the knowledge of how to farm and the wisdom of how to grow food that is more than just stuff to fill our stomachs. Indeed what he is presenting may be the last chance this planet has.

His proposal assumes significance as our existence on this planet gets precarious and as modern industrial agriculture destroys the earth.

Desertification, water scarcity, toxic cocktails of agricultural chemicals are pervading our food chains as ocean ecosystems collapse and soil erosion and massive loss of soil fertility take place all over the world. Our ecosystems ore overwhelmed. Humanity's increasing demands are exceeding the Earth's carrying capacity. Modern agriculture causes topsoil to be eroded at 3 million tons per hour. (that's 26 billion tons a year)

Human mass is replacing biomass and other species. The carrying capacity of the earth is almost spent. To maintain our comfort zone lifestyles we will soon need five earths to sustain us in the style to which we have become accustomed.

Mainstay of any civilization is its agriculture. It thrives and survives on agriculture, because food is all that matters, first and foremost. Two other essential ingredients, water and air are of course free. Industries are artificial and they sap the vitality of human beings and nature. They deplete all resources, human, environmental and natural. Industries are a short run drama and a drama doesn't last very long. Next few decades will see the sad ending of this drama when the curtain of realities falls. Agriculture is real life. Drama is for few hours and real life is forever.

Modern industrial agriculture is a form of molesting earth. Humanity is set to pay a big price for this callousness, for this crime. Lesser and lesser number of people today are having an interest in agriculture. Unscrupulous profit crazy corporations are taking over small farms. These corporations have only one relationship with

Earth - that of exploitation & profiteering. All this can not last forever. We are taking food for granted, we are taking God's nature for granted. Its not going to work. Something has to change and something will change, whether we like it or not.

Agriculture is still the occupation of almost 50% of the world's population, but the numbers vary from less than 3% in industrialized countries to over 60% in Third World countries.

What if the world were an apple? One quarter of the apple is land and the rest is water. Cut the one quarter of apple, that is land, into half and put aside that half which is deserts and mountains. Peel of what is left and that represents the topsoil that must feed the whole world. This analogy illustrates how important it is to get the best out of the available soil to provide abundant and nutritious food for everyone on the planet.

But modern agriculture couldn't care less for this precious resource. Modern agriculture is at war. It is at war with the mother Earth, with the environment. The weapons used in this war are massive agricultural machines, chemical fertilizers, herbicides, fungicides, pesticides and now genetic manipulation of the crops.

At the end of World War II, military industrial complex needed new markets for its surplus chemicals. It gave birth to Agriculture Industrial Complex. Decades of our addiction to these chemicals have led to toxic oceans, toxic water, toxic air and toxic food. From chemical deserts of factor farms to our inner life, our world as a place of nature is unrecognizable.

Most of us are far removed from the fields where our food is grown. Separating us from our food, our primary source of life, is a vast globalized distribution system, controlled my multinational corporations.

Fight against corporate control of our food is the fight for food sovereignty. When corporations dictate what farmers must grow, they are controlling what all of us must eat. The outcome of battle for agricultural control may dictate the future of the Earth.

India - A Case Study

Peter has been working with crisis-struck farmers in India for the past fifteen years and providing a strong grassroots alternative to industrialised conventional agriculture, which is failing on all counts.

India was one of the richest countries in the world, not because of its gold, diamonds or rubies, but because of its bio-mass. In India they could grow anything because of wonderful temperature, wonderful climate, the moisture and the warmth. That was the secret of India's legendary wealth.

India has been an agro-based economy since time immemorial. Cow has been an integral part (backbone) of its agriculture. But during industrial development and Green revolution, they switched over to chemical based and machine based farming, replacing age old methods involving cow dung, cow urine, and bull power.

Today chemical-based farming (Green Revolution) has rewarded India with degradation of soil, low yields of crops, emergence of new pests and diseases and percolation of toxic chemicals into the food chain.

This has resulted in more than 1.85 lakh farmers committing suicide all over India in the last 15 years. For millennia, organic cow based farming was practiced in India without any marked decline in soil fertility.

Green revolution was supposed to alleviate India's hunger. Viewed holistically, green revolution was a failure. Chemical agriculture

destroyed India's natural abundance, farming communities and soil. High yielding plant varieties turned out to use far more water, growing significantly less crop per drop. Today in much of India, rivers have long since dried up. The only water is hundreds of meters down.

Just the thirty or forty years of chemical usage has destroyed the soil which was working flawlessly for thousands of years. International Water Management Institute describes India's green revolution as 'living on borrowed water, and borrowed time'.

As an alternative to this destruction, the method Peter Proctar is proposing is called biodynamic farming. Cow which is venerated in India, is central to this biodynamic farming. With her 4 stomach, she is a unique animal of digestion. Cow dung forms the basis of many biodynamic preparations. Cow Pat Pit (CPP) is one way of processing cow dung. Proctors call is 'Muck And Magic' because the recipe contains mystical preparations.

A farmer who acquired a field six years ago was asked - how was the land when you started? He replied, "It was quite hard, like a rock." Why? "Because they were using chemicals at that time." How is it now? "In last six years, I have put compost and green manure, and it has become like cotton and even further it has become like butter. Its so smooth and easy to cultivate." Why are so many birds here while you are cultivating? "There is such a population of earth worms now, and as I cultivate they eat the earthworms and insects as they come out," came the reply. Healthy soil makes healthy plants, healthy animals and healthy people.

Cow Based Biodynamic Agriculture

Biodynamic agriculture is an advanced form of organic agriculture with an emphasis on food quality and soil health ; and as such, uses no synthetic fertilizers or pesticides. 'Biodynamic' originates from two Greek words, bios meaning life, and dynamos meaning energy. The pioneer of biodynamic agriculture was Rudolf Steiner (1861-1925) an Austrian scientist, philosopher, and educator. He identified the deleterious effects on the soil and the deterioration of the health and quality of crops and livestock that farmers experienced following

the introduction of chemical fertilizers at the turn of the twentieth century. In a series of eight lectures known as the "Agricultural Course" made in 1924 Steiner taught the fundamental ecological principle that the farm is a living organism, an individual self-contained entity within a whole harmonious system. Bio-dynamics is a complete holistic outlook on agriculture. Though the Steiner theory of biodynamics might be a bit esoteric on reading, when it is put into practice, it becomes eminently practical.

Bio-dynamic agriculture is the oldest organic farming movement practiced in over 40 countries in the world. It includes the normal organic farming practices, such as the use of compost, green manures, and crop rotation. In addition, Bio-dynamic agriculture uses a series of Preparations numbered from 500 to 508 which are based on various mineral, plant, and animal substances. These enhance all the bacterial, fungal and mineral processes that are found in the organic farming system. Placing great importance on the auspicious positions of the moon, sun and planets, a Planting Calendar is used for applying the biodynamic preparations, sowing seeds, planting plants, applying liquid manures, spraying fruit trees and crops, and other farming activities. Experience has shown that use of the Bio-dynamic techniques can make all organic farming processes work more quickly and better.

A biodynamic farm is characterized by self-sufficiency and biological diversity where crops and livestock are integrated, nutrients are recycled, and the health of the soil, the crops and animals, and the farmer too, are maintained holistically. Consideration of the farm as an ecosystem feeds into holistic management practices that embrace the environmental, social and economic aspects of the farm.

Its objectives differ significantly from those of conventional agriculture, or agribusiness, which maximizes profit with mechanical and technological inputs for unlimited exploitation of the Earth's resources. The biodynamic model feeds family and farm workers first, and then trade surpluses to the local community. One main difference between organic and biodynamic farms is that organic

farms often exclude animals for ethical reasons and monocrop production is common.

Movements like this may be the last chance this planet has for a healthy, secure, and ecologically efficient food supply.

An Emergent Agricultural Knowledge System Against The Corporate Takeover

Biodynamic farms have broad ecological implications as a blueprint for agriculture when fossil fuels are scarce. But they have cultural implications too. Today in India, biodynamic and organic farming methods represent a revolution, one farmer at a time, against the vested interests of agribusiness disguised as science and the global dominance of corporations such as Monsanto.

The advantage of a cow based biodynamic farming for Indian farmers is that they are practising a form of non-chemical, non-toxic farming that does not require the use of any hybrid or GM seeds. Monsanto is a company that's trying to monopolise seed production and its only objective is that every farmer in the world who buys seed should buy from Monsanto. As 60 percent of India's population depends on small and marginal farming, the impact of stopping traditional methods of seed saving and swapping, and taking farmers to court for patent infringement where they are fined 1-2 million rupees, is literally killing them. Indian farmers want freedom and independence from corporate control. They don't want any Monsanto or Syngenta to tell us what seed they grow and what crop they should harvest and what food to eat. This perspective reflects Gandhi's definition of food sovereignty or the right of all people to decide what they grow and eat free of international market forces.

Peter Proctor's book, Grasp The Nettle explains how it all works. The cow dung is used to create compost and it has to be prepared in a particular way. It involves CPP or Cow Pat Pits where the cow

dung is layered in pits. One preparation involves the dung being put into cow horns and then being buried. It is left in these pits right through winter after which the crumbly textured mix it turns into is mixed with water and sprayed on the crops. This preparation enables the plant to hold on the moisture for longer and helps the roots go deeper. The experiments are a total success – farms that have adopted this method have healthier and juicier crops. Little wonder that Peter Proctor is almost venerated by the rural Indian farmer, many of whom have wiped out their debts and shed the yoke of corporate control thanks to following his 'back to Nature' philosophy. When they hear he's visiting, they come from miles around, sitting around him with their ubiquitous cell phones, waiting to hear the words of wisdom that fall from his mouth about the state of the soil. After all, it's because of him that thousands of Indian farmers have stopped using chemical fertilizers and pesticides and have adopted biodynamics as a way of life.

Maybe it was easier in India than anywhere else in the world. After all, the cow has always been worshipped and it was easy enough to make them see why this way was so much better. Cow dung has traditionally had a number of uses in India – made into cakes and burnt as fuel, mixed with water and applied on floors to prevent insects from coming into the home and to manufacture biogas. And maybe the typical small holding Indian farmer was in tune with his land – and his cow of course – to realize that the so called green revolution, ushered in by the global pesticide manufacturers, only resulted in polluting the soil, poisoning it as well as the ground water. Unlike many other places in the world, the harsh effects of chemical farming were much more visible here much sooner. With over half the population in India depending on agriculture, this was devastating!

Maybe that's why Peter Proctor can be seen working among the rural farmers of India - maybe it was so much easier to convince people who lived in close communion with the land rather than farmers in more westernized societies where it takes much longer for the ill effects of chemical farming to be felt. Maybe when the

holdings are small and so much depends on it, there's a sensitivity to the soil and its needs – and an awareness of when things are good and in harmony with the rest of nature.

India's Organic Farms Work At Village Level

During the past fifteen years, Peter Proctor has visited India twenty five times to teach biodynamic farming methods to as many farmers as possible. Despite his eighty years, he visits ten villages a day. Proctor's involvement is part of a major campaign to promote and encourage alternative forms of agriculture that use no synthetic inputs in response to an epidemic of farmer suicides, most of whom were farming GM crops. This initiative has encouraged 4 million hectares under organic farming methods and 1000 officially supported training schemes for biodynamic and organic farms in the Maharastra region, a suicide hotspot. These farms work at village level and each village has formed an organic federation accredited at district level where farmers participate to solve their own problems. By building up their knowledge base, farmers gain independence from agribusinesses through reducing external inputs. By using biological practices such as green manures, cover cropping, companion planting, and natural insecticides, money is saved that would have been spent on costly pesticides and fertilizers, and is put back into their own communities to improve the quality of life of everyone. This great change in rural prosperity has brought whole communities back together again and enabled the integration of health education in local settings.

The good news about the benefits of this cow based farming has spread quickly and there are now in excess of 2,00,000 compost piles throughout India that recycles cow dung, paddy straw and almost anything else nature provides. Recycling local and freely available resources such as leaves and dung from the ubiquitous and revered

cows provides an appropriate alternative technological strategy for Indian farmers and doesn't cost lives.

Alternatives To The "Green Revolution"

How to Save the World is an award winning independent film that documents the progress of Peter Proctor and his cow based biodynamic farming movement in India. Writer and director Barbara Burstyn treats us to visions of verdant biodynamic farms where colorfully dressed young men and women prepare the field preparations and spray them in spiral motions from large copper bowls onto the soil. The old ploughman driving two golden cows tells his story of how the soil has become soft and almost butter-like and alive with worms under biodynamic systems. Elsewhere, we see vast areas of land where the soil is so saturated with layer upon layer of chemicals that it has become great lumps of dry, dusty boulders where no life exists. Organic farmer Jaspal Singh explains that this is the result of the "Green Revolution", that has not only been a killer of farmers, but has made the soil unproductive, waterlogged, pest infested, depleted of nutrients, and has dried up rivers. Singh says that until he learned about chemical free organic and biodynamic farming systems that uses fifty percent less water, he had no alternative to the chemical and water intensive practices of the Green Revolution.

Despite the negative effects of chemicals on the soil, the use of pesticides is increasing and claims the lives of at least 2,00,000 people per year in India by direct poisoning.

In India, seed dealers get huge commission from chemical companies and Indian farmers are forced to take hybrid seeds and pesticides as part of credit packages from salesmen in order to continue to farm. Shantytowns of farmers evicted from their lands because of failed harvests and unpaid debts have sprung up by the rows of pesticide sellers set up in small roadside huts with shelves filled with packets of GM seeds and cans of pesticides. These seeds cost farmers four hundred percent more and yield thirty percent less. A 2006 report shows that 60 percent of farmers using GM seed could not cover their investment, let alone feed their families.

The film, How to Save the World captures the rhythmical movement and vitality of India, but cannot resist a cynical take on the corporate model that builds a market by forcing once independent farmers into debt and dependence on international aid for the very same grains and legumes they once grew successfully. It puts the blame for dependency and for world hunger fairly and squarely on the shoulders of industrial agriculture, genetic engineering, military dominance and trade liberalization, and not on food scarcity. The failure of the globalised free market is starkly symbolized by miles of empty toll roads, built as an infrastructure for corporate agriculture that many farmers in India cannot afford, or do not want.

How to Save The World leaves us in no doubt that one would be fortunate to find oneself connected to an idyllic rural biodynamic farm where pay and conditions for workers and their families are fair, food is of the highest quality and plentiful, the local economy thrives, the farm shop is a sell out, and the farmer and the local community is happy and content. And there is no reason why million more small to medium sized farming communities everywhere could not enjoy the same good life.

What Peter Proctor is doing however, is starting a revolution – quietly and effectively at the grassroots level of agricultural India. Why did this man come all the way from New Zealand braving the heat and dust of rural India to start a movement that would take on the might of multinationals and their juggernaut on its way to control everything we eat and drink? Why would a man who is partially deaf, with one glass eye, an opera buff, who doesn't particularly like spicy Indian curry come halfway across the world to try and save debt-ridden Indian farmers from the clutches of corporations like Monsanto?

Because he cares. Yes, Peter Proctor cares – and this caring goes beyond the farmers and their plight. He cares about the planet and what we as humans are doing to denigrate it. He cares enough to say, 'Enough!' and to do his bit to work in tandem with Nature, not against it. He cares enough to want to try and bring back the beauty

of balance that Nature should ideally have. To repair the delicate web of interdependence that all creatures in the world should be connected with.

Source

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23.

Save Our Soils

Land Restoration In India's Conflict Zones

India has a total of 671 districts and out of these, 82 districts are severely affected by Maoist insurgency. These insurgents practically control these vast swathes of territories and even security forces have a hard time accessing some of these areas.

Collapsed agriculture and soil erosion is responsible, in no small measure, for the rise of inurgency in these areas. The youth often have no means of livelihood other than joining the rebel ranks.

One such district in Central India's Chhattisgarh state is Kanker. Most of the land here is degraded and agriculture is in shambles.

Government Projects Facing Reistance

In 2010, the government launched an 820 crore rupee ($150 million) initiative to develop the district. This included building roads, supplying electricity and drinking water, building schools and community health centres and implementing the Mahatma Gandhi National Rural Employment Guarantee Act (MNREGA), a programme designed to end rural poverty by giving 100 days' employment a year to the rural poor.

The plan faced stiff opposition from Maoist activists, who said it would only lead to displacement of local tribal people and fill up the pockets of corrupt government officials.

Kalavati Salam, a resident, recalls how Maoists disrupted a government project in 2010. "We brought in trucks full of stone chips, cement and sand to build a tar road. But when the bulldozers came, they set them afire. We had to stop the work and couldn't spend the budget allocated for the project."

A half-built archway at the village entrance, together with heaps of stone and concrete on the roadsides, back up her testimony.

Maya Kavde, head of Makdi Khuna, another village in the same district, says suspected Maoist activists recently vandalised a mobile phone tower in her village by cutting wires and pulling apart the antennas.

Four years after Kalavati Salam was elected to lead the Nangarbeda village council in Central India's Chhattisgarh state, she has finally got her first development plan rolling.

The plan, focused on reversing land degradation and boosting crop yields, benefits from a generous budget and a dedicated work force. Equally important, it has the support of the Communist Party of India (Maoist), a banned political organisation that has blocked many previous development efforts.

"Now we are taking up works like restoring village land. We are trying to change the definition of development," she adds, visibly relieved.

When we examine the facts, we must put the Northern Indian cultivator down as the most economical farmer in the world as far as the utilization of the potent element of fertility—nitrogen—goes. In this respect he is more skilful than his Canadian brother. He cannot take a heavy overdraft of nitrogen from the soil. He has only the small current account provided by the few pounds annually added by nature, yet he raises a crop of wheat on irrigated land in the United Provinces that is not far removed from the Canadian average. He does more with a little nitrogen than any farmer I ever heard of. We need not concern ourselves with soil deterioration in these provinces. The present standard of fertility can be maintained indefinitely.

~ Sir Albert Howard (The Waste Products Of Agriculture And Their Utilization As Humus)

The process includes levelling the land, clearing it of stones, and then covering it with cow dung.

"Most of the farm plots here are uneven, lifeless. We remove layers of soil from those plots that are higher, until the entire farm is at the same level," says villager Sonkumari Bai, 42. "We also remove big and small stones. Sometimes we winnow the top soil before putting it back into the land. *Finally, we till the land and cover it with dried cow dung and gypsum."*

The inhabitants of Nangarbeda, which has a population of 2,700, hope this will help improve their harvests.

"The temperature here is increasing day by day. Earlier in the summer, we would grow vegetables like cucumbers and cow beans. But now the land is so dry, we can grow nothing," says Bhagobai Pradhan, who has a three-acre farm. "This treatment has made some difference. When the rain comes, the once-tilled land will get soaked easily and the cow dung will mix with it well."

In India with small holdings and small scale farming, there is no better alternative to employing cattle in farming.

While ploughing, the oxen stride with gentle gait, not harming the surface of the earth, unlike tractors.

Even as they plough the land, the oxen defecate and urinate, fertilising the land.

Cattle Manure : organic manure, green leaf manure, earth-worms, and slurry manure with cattle manure bond with the nature and make the land fertile. They do not create the challenge of chemical waste.

99% of the pests in nature are beneficial to the system. Insecticides prepared from cow urine or well fermented butter milk do not affect these helpful pests.

Dung from one cow is adequate to fertilise upto 30 acres of land and its urine can protect upto 10 acres of crops from insects.

Nanak Baghel, a senior Maoist leader in Kanker, says his party fully supports the land restoration project.

"We are against the government-backed so called development projects that are just tools to systematically destroy the tribal people. But we never oppose people's right to better land, water or forest," says Baghel, an area commander.

Sukhanti Bai, head of Handitola village in another conflict-affected district, Rajnandgaon, describes how soil degradation and falling yields have pushed villagers to restore their land too.

"There are many companies here mining for iron ore and limestone. They have caused a lot of deforestation. Also security forces cut many trees to build their camps inside forests. Now, we have less rain and a lot of dust coming from the mines and damaging our fields," she explains.

"Everyone in my village is experiencing a 10 to 20 percent drop in rice yield. Last year, we held a meeting to discuss what work we must make a priority, and everyone said it should be land restoration," she adds.

The majority of the local people are landless, marginal farmers who own less than 2.5 acres of land.

According to Luc Gnacadja, executive secretary of the United Nations Convention to Combat Desertification (UNCCD), including land in development plans will help nations fight food insecurity. "Avoiding land degradation and restoring degraded

"We have got experience. Sometimes we find in mango season profuse mango supply. People cannot end it by eating. And sometimes there is no mango. Why? The supply is in the hand of God through His agent, the material nature, this earth. The earth can produce profusely if people are honest, God conscious. There cannot be any scarcity. Therefore it is said that kamam vavarsa parjanyah [SB 1.10.4]. God gives. Eko yo bahunam vidadhati kaman. Nityo nityanam cetanas cetananam (Katha Upanisad 2.2.13). So God, Krsna, fulfills all our desires."

-Srila Prabhupada (Srimad-Bhagavatam 1.10.4, Mayapur, June 19, 1973)

land should be a centrepiece to every state's development plans," Gnacadja said in a recent interview.

For local people, the land restoration projects in these villages are not only a step towards ensuring food supplies. They also create a more secure working environment.

Ramulu Amma, a 32-year-old villager in Peda Bandirevu, says she feels safer now. We are working to improve our own fields and there are no feelings of fear or insecurity now.

Source
Stella Paul, Reuters, 7 May 2013
Peoples War in India Clippings, Signalfire, 7/5/2013

24.

Save Our Soils

Grazing

A Time-Honored Agricultural Practice

And Its Far-Reaching Benefits In Maintaining The Health And Vitality Of A Landscape.

Excessive pressure on the vegetal cover by animals can be a crucial problem, especially in developing countries where rangelands usually are much more crowded than in the developed world (FAO,1983). While livestock does not necessarily cause environmental problems, overgrazing can be a major factor in land degradation, causing half of the damage assessed in Africa and one-fourth in other developing regions.

Cases such as the damage caused by goats in the Mediterranean area and elsewhere are well known. In Africa, the increase in cattle numbers and the decline in the quality of rangelands have been significant during the recent decades (FAO,1986). These two trends are obviously incompatible in the long run, and local crises are likely in the future.

Nomadic grazing in semi-arid areas is an environmentally compatible, effective land use system developed over the centuries by pastoralists; but local collapses of such systems are being noted with increasing frequency. *Human greed, rather than human need is to be blamed for much of the damage inflicted.*

Cows - The Art Of Living In Perfect Harmony With Other Life Forms

By Morgan Kelly, February 21, 2012

In August, the Princeton researchers reported in the journal Evolutionary Ecology Research that cows paired with wildlife gained 60 percent more weight than those left to graze only with other cows.

Princeton University researchers are leading an effort to put to pasture the long-held convention of cattle ranching that wild animals compete with cows for food.

Two recently published papers — including one in the journal Science — offer the first experimental evidence that allowing cattle to graze on the same land as wild animals can result in healthier, fattier bovines by enhancing the cows' diet. The findings suggest a new approach to raising cattle that could help spare wildlife from encroaching ranches.

The reports stem from large-scale studies conducted in Kenya wherein cows shared grazing land with donkeys in one study and, for the other, grazed with a variety of wild herbivorous animals, including zebras, buffalo and elephants. The lead author on both papers was Wilfred Odadi, a postdoctoral research associate in the lab of Dan Rubenstein, the Class of 1877 Professor of Zoology and chair of Princeton's Department of Ecology and Evolutionary Biology.

In August, Rubenstein and Odadi reported in the journal Evolutionary Ecology Research that cows paired with donkeys gained 60 percent more weight than those left to graze only with other cows. The researchers proposed that the donkeys — which were chosen as tamer stand-ins for zebras and other wild horses — ate the rough upper-portion of grass that cows have difficulty digesting, leaving behind the lush lower vegetation on which cattle thrive.

In September, Odadi and his co-authors on the Science paper reported that other grazers, especially zebras, did remove the dead-stem grass layer and that cattle indeed seemed to benefit from sharing land with wild animals. Cows in mixed grazing pastures took in a more nutritious diet and experienced greater daily weight gain. — but this effect was limited to the wet season.

Nonetheless, the Princeton studies help counter an enduring perception that wildlife is an inherent threat to the food supply of livestock, Rubenstein explained.

These results could prove crucial to preserving animals that are increasingly threatened as the human demand for food drives the expansion of land used to raise cattle. Zebras and wild horses are especially vulnerable to the spread of pastures because of their abundance.

"Grazing competition from other animals has been an issue throughout history," Rubenstein said.

"There's a fear that if some other animal is eating grass meant for livestock, that hurts the rancher. Those perceived competitors were seen as vermin and exterminated," he said. "These experiments suggest that in certain cases cows can actually experience considerable advantages in terms of growth when allowed to graze with other species."

The Benefits Of Grazing

By Kate Campbell, July/August 2009 California Country magazine

Cattle grazing, and other good range management practices, can add greatly to the health and vitality of any landscape.

In the spring, California rangeland is carpeted with wildflowers and dotted with grazing cattle. In the fall, the grassy meadows look like brown velvet and wildlife rattles the chaparral.

Monterey County rancher George Work says the beauty of this ever-changing landscape is one of his greatest pleasures because he knows cattle grazing, and other good range management practices, can add greatly to the health and vitality of this important native landscape.

Through a variety of wildlife management techniques, the Work Family Ranch has more than 300 different species thriving there, including tule elk, which at one time were nearly extinct. Along with that, there are several hundred head of cattle and a small herd of horses.

"I grew up here and took over management from my father in the 1950s," Work said. "We've run cattle and farmed dryland grain and hay since the 1800s. In those days, exotic annual grasses began to take over, creating a significant impact on the land. And there were other forces—erosion, invasive plants and animals, as well as grazing practices—that left their marks."

Today the family manages the ranch using techniques very different than the ones employed by early California ranchers. These days the Works focus on a "whole system approach" that takes into consideration the needs of a complex environment.

To ensure a healthy environment in the future, the Works make decisions about the land based on how it exists today.

"Our family uses a holistic decision-making process that aims for outcomes that are ecologically sound, socially just and economically viable," Work said.

The cattle part of the family operation has undergone a dramatic transformation with the adoption of holistic management techniques, he says, explaining that seeing how all parts of the landscape work together aids in managing for a healthier environment.

Rather than raising cattle as an end in itself, the Work family, and many like them, now view cattle as a tool for good range management.

"Some years back we realized that we're not really in the cattle business," Work said with a chuckle. "That was a surprise. What we found is that we're really grass farmers. The cattle are just a way to harvest it and make a living."

To improve the grasses on his ranch, Work says they've combined herds to makes it easier to use the cattle in ways that benefit the range. This also provides recovery periods for the plants.

"But grazing isn't the only thing that impacts the range. A big problem we have in California is invasive species," he said. "Grazing is probably one of the most important tools we have for controlling things like yellow starthistle. Cows, sheep and goats all eat it."

A native of Eurasia, yellow starthistle was introduced accidentally sometime around 1849. Alvarez says it is by far the fastest-spreading and most-invasive nonnative plant the state has ever seen.

Work offers another example of how cattle improve the rangeland. To begin a habitat restoration project, the family used their cattle to knock down invasive, fire-prone brush and allow a greater variety of native plants to return. They tossed some alfalfa hay into the area they wanted cleared and turned the cattle in.

"In two feedings of about 15 minutes each, the hungry cattle crushed the brush with their excited behavior," he said. The trampled brush provided ground cover to prevent winter erosion from runoff and spring brought a resurgence of perennial grasses and tender sprouts, which was wonderful deer feed."

Ranchers agree that there's a change in the way people think about grazing, a growing recognition that, when done properly, there can be far-reaching benefits from this time-honored agricultural

"The philosophy for improving or restoring the environment used to be, remove humans, leave it alone and the land will go back to nature," said environmental activist and author Dan Dagget.

The problem with removing people and their food-producing activities from the land, he says, is that "humans are an important part of the very ecosystems we're trying to restore.

"Removing ourselves from (the landscape) dooms us," he said. "It's like trying to put back together an extremely complex puzzle with a very important piece missing—us."

practice. But, they also understand that past practices have done damage to the environment and created public concerns.

"Managed grazing, when it's done well, actually enhances the organic matter in the soil, improving its ability to store carbon," said Shasta County rancher Henry Giacomini, who is chairman of California Farm Bureau Federation's Public Lands Advisory Committee. "And, it improves the water and mineral cycles and allows the whole ecosystem to function in a way that's healthier.

"At our ranch we use irrigated pastures and concentrate the cattle, moving them every day. We monitor the condition of residual grass after we move them and watch to see how well the grasses recover after a rest.

"We use buffers along our creeks, ungrazed strips of grasses that can filter material running off the fields," he added. "That technique protects the stream banks from erosion and improves water quality.

Noting that grazing animals, including great herds of elk and deer, have been a vital part of the state's grassland ecology for thousands of years, Giacomini said Farm Bureau policy recognizes that grazing is the most practical and environmentally acceptable way to prevent the buildup of excessive, dry vegetation that can lead to catastrophic wildfires.

Grazing Offers A Bounty Of Benefits

Grazing animals can be an important factor in maintaining balanced and diverse ecosystems. Researchers say there are a number of very important environmental benefits from responsible grazing of public and private lands. Those benefits include:

Benefits To Plant Life

Open grasslands and woodlands are generally dominated by non-native and/or invasive annual grasses and herbs.

The vegetation, when left unmanaged, tends to inhibit the germination and growth of other plants by using up most of the available water and mineral resources in the soil and by producing large amounts of thatch.

Livestock grazing controls the growth of the non-native grasses and herbs so that other desirable plants (wildflowers and native grasses) can regenerate and coexist with them. Many plants, including several endangered species, require grazing to maintain viable populations.

Benefits To Wildlife

Well-managed livestock grazing increases the diversity of habitats available to wildlife species. Many species, including several endangered species, benefit form the vegetation management performed by livestock.

Ground squirrel colonies in grazed areas support the foraging needs of predators like bobcats and golden eagles and at the same time, recreate underground tunnels that are used by insects, reptiles, amphibians, and many small mammals. Burrowing owls, kit fox, and badgers occupy them as well.

Biomass Production

Hoofed animals play a major role in regulating primary production (energy produced by photosynthesis) in grazing ecosystems (Huntly 1991). Defoliation can promote shoot growth and enhance light levels, soil moisture, and nutrient availability (Frank et al. 1998). Overgrazing, however, can significantly reduce biomass production.

Seed Production, Dispersal, and Germination

Grazing animals can decrease flower and seed production directly by consuming reproductive structures, or indirectly by stressing the plant and reducing energy available to develop seeds. Grazing animals can also disperse seeds by transporting seed in their coats (fur, fleece, or hair), feet, or digestive tracts (Wallander et al. 1995, Lacey et al. 1992). For some plant species, grazing animals may facilitate seed germination by trampling seed into the soil.

Protection From Erosion

Organic components of feces and urine from grazing animals can build soil organic matter reserves, resulting in soils having increased water-holding capacity, increased water-infiltration rates, and improved structural stability. These changes can decrease soil loss by wind and water erosion (Hubbard et al. 2004).

Incorporating Organic Matter

The hoof-action of large grazing ungulates can incorporate plant material into soils and increase organic matter.

Ecosystem Processes

Grazing contributes to nutrient cycling and the food web.

Fire Hazard Reduction

Properly managed livestock grazing helps to reduce fire hazards by controlling the amount and distribution of grasses and other potential fuel.

Ponds developed for livestock watering support large numbers of breeding amphibians, which also feed on the abundant insect life found in the grasslands. Proper utilization of livestock grazing promotes healthier, diverse wildlife populations in parks.

Herbivores consume plant leaves, stems, flowers, seeds, and sometimes roots. Patterns of herbivory largely determine plant community composition, structure, and productivity.

Through hoof action, pawing, and wallowing, grazing animals trample plants, break up soil surfaces, incorporate seed into the soil, and compact soils.

Grazing animals contribute to nutrient cycling by depositing nitrogen-rich urine and dung, and their carcasses can provide an important contribution to the food web.

In human-controlled grazing systems, the detrimental or beneficial effects of grazing are largely determined by how and where grazing is used. The negative impacts of livestock grazing are often the result of misuse.

Grazers enhance mineral availability by increasing nutrient cycling within patches of their waste and increasing nitrogen availability to plants (Holland et al. 1992). In natural grazing

systems, the decomposing carcasses of wild animals provide feasts for decomposers and scavengers, constituting a central node in the food web (Dunne et al. 2002). However, in grazing systems managed by humans, livestock carcasses are often removed from the environment.

Grazing Can Alter Fire Regimes

Fire frequency, intensity, and behavior are dictated largely by type, condition, and quantity of vegetation (DiTomaso and Johnson 2006). Grazing alters fuel-load characteristics by changing plant community composition, structure, and biomass.

Source

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"Modern agriculture is the use of land to convert petroleum into food. Without Petroleum we will not be able to feed the global population."
-Professor Albert Bartlett

THE AUTHOR

Dr. Sahadeva dasa (Sanjay Shah) is a monk in vaisnava tradition. His areas of work include research in Vedic and contemporary thought, Corporate and educational training, social work and counselling, travelling, writing books and of course, practicing spiritual life and spreading awareness about the same.

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Life Is Nothing But Time - Time Is Life, Life Is Time
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As Long As There Are Slaughterhouses, There Will Be Wars
Peak Soil – Industrial Civilization, On The Verge of Eating Itself
Corporatocracy : The New Gods – Greedy, Ruthless And Reckless
(More information on availability on DrDasa.com)

Two millenniums ago, a great fire ravaged Rome for six days, destroying 70 percent of the city and leaving half its population homeless. Rome's emperor at the time, Nero 'fiddled while Rome burned'.

Today the world is on fire and we, the modern day Neros, are busy fiddling. We are too caught up in frivolity to see the existential challenges staring us in the face. For example, climate change is for real and it's coming around faster than you think, as proven by the catastrophic events all over the world. But it has become a cliche before it has even been understood.

While we are busy merrymaking, another silent global crisis is creeping up on us. It is called soil degradation. In the past 40 years alone, 30 percent of the planet's arable land has become unproductive due to erosion. At current estimates, nearly all of the remaining 11 billion acres of cropland and grazing land suffer from some degree of erosion.

"We are overlooking soil as the foundation of all life on Earth," says Andres Arnalds, assistant director of the Icelandic Soil Conservation Service.

Essentially, all life depends upon the soil. Some one has rightly put it, "Despite all our achievements we owe our existence to a six-inch layer of topsoil and the fact that it rains."

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