



## Why Plants Are Vital

Charlie Jarvis

**Man depends on plants for his food – directly through crops and indirectly through animals – and all our staple foods are derived from only about 30 species of plants. Yet we continue to fell the forests and clear land, exterminating plants that could possibly avert disasters in the future – just as the apparently useless wild wheat discovered in Turkey in 1948 proved to be resistant to certain diseases, including four races of rust, and is now used to breed rust-resistant hybrids. The author lists some of the disasters now occurring, such as siltation of waterways resulting from erosion due to forest destruction – some bulk cargoes are now diverted round Cape Horn due to silt in the Panama Canal. He asks, how severe must ecological disasters become before we recognise our dependence? Dr Jarvis works for IUCN's Threatened Plants Committee (TPC) at the Royal Botanic Gardens, Kew.**

Plants, micro-organisms, and whole ecological systems have been relatively neglected by conservationists in the past. It is usually possible to find out which large animals are to be found in a given national park, but how many national parks can supply a list of the plants upon which the animals depend. The FPS's adoption of the plant kingdom, so becoming the Fauna and Flora Preservation Society, is part of the growing recognition of the need for a broader approach.

A few years ago, in an area of upland Malaysian rain forest near Kuala Lumpur, a yellow lemon-like fruit was found on a forest path. This sparked off a detailed search for the plant responsible, because little is known about the wild relatives of citrus fruits. It turned out to be a new species of citrus which could be useful in commercial breeding programmes for its tolerance of wet

conditions. If this useful species had grown in the lowland forests, it could have become extinct without being found because a great deal of this forest has been destroyed.

This is one example of the valuable resources which tropical forests contain, and is one of the reasons why conservationists, agriculturists and plant breeders all know that the conservation of rain forests and other types of natural vegetation is important.

However, governments, industry and commerce often consider conservation to be anti-development, anti-progress and anti-change. This image is one which the International Union for Conservation of Nature and Natural Resources (IUCN) is eager to dispel and is one of the main points made in IUCN's World Conservation Strategy launched last March. The report presents a new strategy for combining the conservation of natural resources with economic efficiency.

Two-thirds of the world's resources are currently consumed by a quarter of the world's population, while about half the human population is struggling to find enough food and fuel to stay alive. Meanwhile the earth is being made progressively less fit to support life. Food depends on agriculture and good agricultural land accounts for only about 10 per cent of the earth's land surface. Soil erosion, usually resulting from poor land management, and conversion of farm land for building purposes are proceeding at such a rate that a third of all existing good agricultural land will have disappeared in 20 years.

### **Desertification and Deforestation**

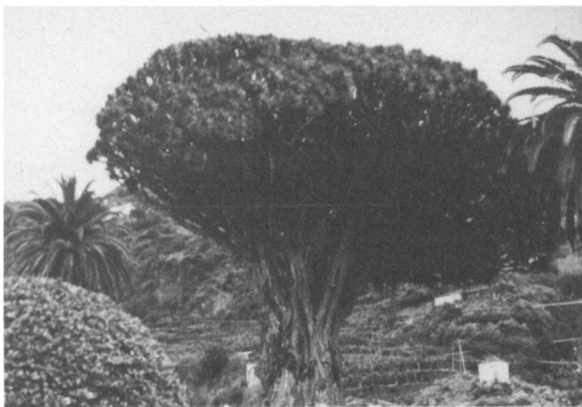
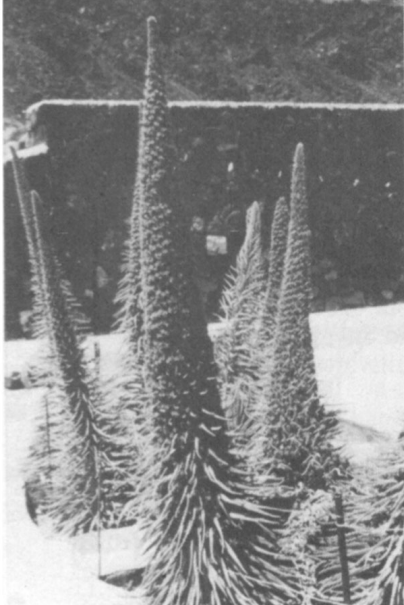
Every year desert increases by an area twice the size of Belgium. Pressure increases on marginal agricultural lands and the people dependent upon them. Fisheries in many parts of the world are seriously depleted by overfishing and pollution. Deforestation in tropical forests for agriculture, fuel, chipboard and timber is proceeding at a rate variously estimated at between 20 and 45 hectares a minute and there will be few if any areas of primary rain forest left in 30 years.

The human population is expected to increase by nearly half, to just under 6000 million during the next 20 years. It is unrealistic to expect the earth to be able to support so many people without a hiccup when 800 million people are destitute now. Changes in planning policies must be made if a global disaster is to be averted.

The World Conservation Strategy aims to show that conservation and development go hand in hand and that sustainable development can only be realised through the conservation of natural resources. Four priority problem areas are identified in the strategy – agricultural systems, forests, the sea and endangered species.

Much of the emphasis here is on the maintenance of the life-support systems and ecological processes upon which we depend. These include the oxygen and carbon cycles, the processes of soil formation and nutrient recycling, and the air and water cleansing systems, most of which operate via living ecosystems.

Plants are important because they are at the centre of the energy system upon which man depends for his food, both through crop plants and indirectly through animals. The change of use of agricultural land is an extremely serious and urgent problem. Although new high-yielding varieties of many crop plants are increasingly used, these can bring other problems. Improved crop varieties often have a relatively short useful life, as they become increasingly vulnerable



*Above:* The endangered Canary dragon tree *Dracaena draco*, now confined to steep cliffs in Tenerife and threatened following the building of a road tunnel

*Left:* A red echium *Echium wildpretii*, native to Tenerife and La Palma in the Canaries, considered vulnerable in the wild

to pests and diseases, while crop requirements and soil conditions also change.

The green revolution, aimed at increasing arable production, has also had the effect of dramatically reducing the genetic diversity of most crop species, which in turn renders them much more vulnerable to serious attack by pests and diseases. The widespread use of these newer varieties in Third World countries has led to the replacement and extinction of many primitive cultivars which possessed potentially useful features for incorporation into subsequent breeding programmes.

The safeguarding of genetic diversity in species upon which we depend is extremely important. For instance, today's European grape vine owes its existence to disease-resistance provided by American stocks. During the 1860s *Phylloxera vastatrix*, an insect on the roots of vines, was accidentally introduced into Europe from its native North America. European cultivars, although of high quality through quite long selection, had no resistance to this pest; almost all vineyards were destroyed and the wine trade almost ruined. However, several North American vines showed resistance to *Phylloxera* and the grafting of European varieties on to American rootstocks enabled European vineyards to recover. This procedure continues today.

Another plant, maize, is the third most important cereal in the world. The United States supplies 60 per cent of the maize entering world trade. It is an annual crop and a significant part of the cost of its cultivation is in clearing and replanting. During 1978 a new perennial species of maize, *Zea diploperennis*, was discovered high in the mountains of south-west Mexico. It is relatively tolerant of cold and damp conditions and appears to cross successfully with commercial maize. This species is also immune to four of the seven major viruses to which field maize is vulnerable. It is hoped that the perennial habit and other useful characteristics can be incorporated into commercial maize to expand the areas where the crop can be grown and improve disease resistance.

The preservation of such variation in crop species and their relatives is important if we are to be able to modify their characteristics to cope with diseases and pest resistance in the future. It is difficult, if not impossible, to anticipate those features which it may be important to conserve. Recently various crop cultivars have been screened for high levels of particular amino

acids; not a feature that could have been anticipated as of likely importance a few decades ago. The wheat collected by Professor J. R. Harlan in Turkey in 1948, apparently useless, turned out to be of inestimable value. The plant showed low yield, collapsed in bad weather and gave flour with poor baking qualities, but when a rust disease became widespread in the United States, this strain was tested and found to be resistant to four races of rust and a large number of other infections. It is now employed in many wheat breeding programmes in North America and improved cultivars have been extremely successful.

Bearing in mind our dependence upon only about 30 species of plant for almost all our staple foods, the destruction of genetic variability in wild stocks is an act of sheer irresponsibility. Developing countries, where many of these stocks are to be found, may reasonably expect help from the developed world towards the cost of conservation, for important crop species are usually grown most extensively anywhere but their place of origin. Coffee, which originates in Ethiopia, achieves maximum production in Central and South America. Soya beans originate in north-east Asia but are farmed most intensively in the United States. In fact more than 98 per cent of crop production in the States is based on non-native plant species.

Equally serious is the problem of deforestation. Watershed forests protect other areas downstream from sudden fluctuations in water flow which may result in floods or droughts. The degradation or removal of these forests leads to soil erosion and devastating flooding often results, such as that seen in India and Bangladesh. Sediment loads of rivers increase greatly, filling reservoirs with silt and reducing their useful life, and extremely costly dredging exercises are then necessary to keep waterways and harbours open for shipping. Poor watershed management has caused heavy sedimentation in the Panama Canal, curtailing the amount of shipping using it. Some bulk cargoes are now taken around Cape Horn instead.

### **1500 Million People Need to Burn Wood**

Forests also supply a vast range of important potentially renewable products for local communities. Firewood is a major use. It is estimated that more than 1500 million people depend on wood for heat and cooking. Forests have also provided areas of short-term shifting cultivation for millions of partially nomadic people over thousands of years. However, rapidly increasing populations subject these forests to much greater pressures than they can withstand. Cleared areas are left fallow for shorter periods so that the soils are poorer and will support crops for less time, while the areas cleared are far larger resulting in slower regeneration and forest fragmentation. Degradation of the forests leads once again to soil erosion and the search for new forest areas to exploit.

Tropical rain forests are the most species-diverse type of land environment on the earth and are increasingly being exploited for timber and pulp. This is mainly due to increased demand from the developed world which will probably more than double over the next 20 years. Although such forests supply less than 10 per cent of current world demand for wood, this proportion is likely to increase rapidly in the future. Many countries in the tropics are rapidly expanding their forest exploitation. In Cameroun, timber extraction has recently been accounting for about 1.3 million cubic metres of logs per year

and the Government hopes to double this as soon as possible. There is also a project to use hardwoods to make paper pulp (normally softwood species such as pines are used) all of which will be exported to Europe.

In Central and South America, a major threat to forests is from cattle raising. Demand for beef continues to grow in North America, Europe and Japan, but it is costly to produce. It can be produced at about a quarter of the cost on ranches created by felling rain forest in these countries. Unfortunately, the productivity of grassland on these nutrient poor soils declines and the ranches become unprofitable after a short time. It is then easier to move to another area of forest and start again than to improve the pasture. This grass-fed beef is ideal for the rapidly expanding fast food trade in hamburgers, and market pressures to keep prices down in the United States are ensuring a high level of demand for foreign beef which in turn causes further forest conversion.

### Wild Relatives Will be Needed

The number of species in tropical rain forests is so vast that very few have been seriously investigated for features useful to man. A few of the products of forest species are familiar – rubber, coffee, bananas, cashew nuts, avocado pears. These are all now cultivated, but improvements in these crops are likely to be dependent upon wild relatives, all of which occur in tropical rain forests. A far wider range of species is utilised by local people both for food and for medicinal purposes. The potential fund of knowledge embodied in traditional plant usage in the tropics has only recently been recognised by the developed world.

The World Health Organisation now has a programme for testing indigenous plants which are used locally for fertility regulation (the active constituent in the Pill originated in a species of Mexican yam). A whole range of other drugs are obtained from forest species. Quinine comes from a species of *Cinchona*, a forest tree. L-Dopa, used in treating Parkinson's disease, also comes from a tropical plant species, and a range of anti-cancer drugs have recently been found in a Madagascan periwinkle.

The use of herbal drugs remains the main form of medication in a great many countries, and in India well over 500 different plant species are in use for this purpose. Yet many, such as species of *Rauvolfia* (used in the treatment of hypertension) and *Dioscorea* (yielding cortisone used in treating rheumatism), are now scarce from overcollection.

### Extinction Before Discovery

There are also a great number of species used locally for food purposes which could be used much more widely. The yeheb nut is a highly nutritious drought-resisting legume from Ethiopia and Somalia. A marine flowering plant from Mexico yields grain that can be ground for flour. Another leguminous tree from Chile bears highly nutritious leaves and pods and thrives in extremely salty soils. These and many more species could be of immense value in the future, but it is essential that such species are not allowed to die out before their value can be assessed. So many plant species remain to be discovered, let alone considered for possible crop use or screened for chemicals with useful properties, that it is certain that many, perhaps vitally useful, plants will be destroyed before any assessment of their value can be made.

It follows that it is essential to gather information urgently about the earth's threatened plant species, and this is the purpose for which IUCN established

the Threatened Plants Committee (TPC) in 1974. The TPC estimates that about 10 per cent of the world's flowering plants (i.e. about 25,000 species) are under severe threat of extinction. Data for species in the temperate developed regions are relatively easy to obtain, and lists for Europe and North America now exist. However, the moist tropics and arid zones with their poorly studied floras and few botanists, present much greater difficulties. Lists are, however, in preparation for many of these areas including tropical Africa, Central and South America and many island systems. The different threats facing many assorted types of plant species in various parts of the world are described in the IUCN Plant Red Data Book (TPC, The Herbarium, Kew, Richmond, Surrey, £10.)

It is inevitable that large numbers of species will become extinct, and conservation action must be realistic. It is irresponsible and useless to put a fence around an isolated water hole to protect a plant if the people who use it have no alternative water source. The conservation of plants in natural habitats should be the fundamental aim, but where this is impractical, stocks should be transferred to botanic gardens. Seed banks also have an important role, particularly for crop plants. Applied research is urgently needed into new potential crops and into agroforestry – a method of cropping which combines agriculture and forestry, fostering diversity. This is likely to be very important in maintaining tropical forests.

Man, particularly in the developed countries, frequently forgets that he is dependent upon plants and the biosphere. How severe must ecological disasters become before this fact is conceded?

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This article first appeared in *The Guardian* in September 1980.

## Disappearing Bats

In a survey of 129 British bat colonies randomly reported to the NCC in 1978, Dr Bob Stebbings of the Institute of Terrestrial Ecology reports that in the ensuing year 56 disappeared completely, 21 declined by more than a quarter (13 of these by more than half) and 52 remained more or less the same. Of the 56 lost colonies, 16 disappeared for 'natural' (i.e. unknown) reasons, and 40 because of householders sealing off entrances to roosts – usually while the bats were out, although one man admitted sealing 300 of them in – by spraying the bats with insecticides (illegal) or by treating rafters for woodworm. Of the colonies that had declined rather than disappeared, the cold winter and summer of 1978 is given as the probable reason. In determining the species involved, Dr Stebbings had to rely on respondents' descriptions, which when given at all tended to be inadequate, but he assumes that almost all were Britain's most common bat, the pipistrelle *Pipistrellus pipistrellus*.

## Preserving the Hangul's Food

The August *Oryx*, p316, reported the removal of the Government sheep-breeding station from the Dachigam Sanctuary in Kashmir, which should greatly improve conditions for the seriously endangered Kashmir stag, the hangul *Cervus elaphus hangul*. Dr G.M. Oza of the University of Baroda, who has studied the stags in the Sanctuary, writes to say that he believes the hangul can be saved if the right food plants are preserved. He has established the deer's annual migration pattern and has listed the plant species that they favour on their routes. The State Forest Department, he says, has 'a heavy responsibility' to preserve the vegetation of what is still excellent habitat.