

a lack of interest in and capacity for work, a depression of stamina.

Periods of inactivity, complete or partial, when circumstances refuse any reasonable outlet of energy, particularly useful energy, is another form of monotony having similar effect. It is important to recognize that change and variety of occupation and interest represent for human beings a form of rest, physical and mental. The Germans take this point seriously, encouraging frequent holidays and strenuous physical exertion on the part of higher officials.

As in the case of those tending to improve morale, factors of a deteriorating nature may well be multiple and indeed often are. They then tend to exaggerate the respective reactions. States of chronic fatigue from one cause or another clear the ground for fear and depression; conversely, situations likely to produce the latter will aggravate the unpleasant sensations of fatigue.

Conclusion

Morale, more particularly in its national aspects, requires serious attention. The problem in the case of the disciplined soldier is much easier, something concrete has been prepared to work on; it is a very different matter with the shifting unstable masses of a civil population exposed to novel and dangerous stresses. The strain is not merely physical; all sorts of real and imaginary threats hang darkly upon the horizon, stripping away ancient securities and landmarks.

It will not have escaped notice that some, at any rate, of the factors concerned with morale can be directly influenced by deliberate effort, by taking thought. Such effort need not solely derive from authoritative sources but should reasonably come within the province of every responsible person.

Both sides in this Second German War—the Second Punic War—have advantages and disadvantages. The stability and resolution of the Allies may be set against the plasticity and discipline of the Axis peoples. That on the whole the balance would appear to favour the former need not encourage neglect of a factor of increasing, perhaps ultimate, importance.

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WILD LIFE IN THE WESTERN HIGHLANDS*

By SETON GORDON, C.B.E.

THE War has little affected the Western Highlands. It has, of course, been in the favour of those animals and birds which are sometimes classed as vermin. But I think that this is a narrow-minded and repellent term, given by those whose lives were formerly devoted to the care (and then the destruction) of the red grouse.

This is the third early summer season that the Highland deerstalker and the Highland gamekeeper

* Substance of a lecture at the Royal Institution on May 29.

have been on 'active service', and the most noticeable result of this absence is the spread of the fox. The fox has now become a menace to crofters and sheep farmers in a number of West Highland districts. More than forty lambs were killed last spring near us in Skye.

The wild cat is also on the increase, although not to the extent that might have been imagined. A deerstalker wrote that he recently found the carcass of a wild cat at a golden eagle's eyrie. There must have been a great fight before the eagle was able to kill the cat—unless indeed the King of Birds had happened to come upon the cat asleep. I have visited many eyries of eagles, but I have never seen a wild cat brought as prey, although I have seen the remains of a stoat more than once. A deerstalker once described to me a tremendous onslaught by a golden eagle upon a wild cat. The eagle swooped on the cat thirty or forty times, with its great talons ready to grasp it. Once, as the eagle came very near, the cat sprang into the air, striking at the eagle with its claws. The spring was so great a one that the stalker saw the whole of the cat for a second suspended in mid-air.

During the month of May, some years ago, my wife and I had a 'hide' at a golden eagle's eyrie on a rock up a lonely glen. We stayed with the stalker in the only house in the glen, and from the stalker's house to the eyrie was a distance of two miles or more. There was a blackbird living near the stalker's lodge. One night my wife had taken an all-night watch in the hide. Eagles sleep very late (for birds) since there is no necessity for them to search for the early worm, and the birds and beasts on which they prey are not usually in evidence until the sun is well up. The blackbird had taken a flight far afield that morning, and before sunrise flew up and perched in the small rowan tree that grew beside the eyrie. Here he began to sing and his song awakened the sleeping eagle on the eyrie. The eagle aroused herself, and glared balefully at the blackbird, which at once flew off to more healthy surroundings.

In the West Highlands is a high cliff where a pair of eagles and a pair of ravens nest. It is astonishing how hard the eagles are mobbed by the ravens, which attack them in the air for half an hour at a time. The ravens have to fly at their topmost speed to keep in touch with the eagle during its downward swoop. The eagles very occasionally turn half-heartedly upon their persecutors, but for the most part treat the attacks with indifference. Only last week I saw this eagle attacked previously by a pair of kestrels. Upon occasion I have seen two eagles attacked in the air by a single raven. Golden eagles do not often nest on cliffs beside the sea. I have seen one eyrie in this site, and the ground at the head of the cliff was honeycombed with rabbit burrows, so that the eagles had not far to fly for food for the two eaglets in the eyrie.

Near that eagle's eyrie is a colony of fulmar petrels. In the British Isles the fulmar is increasing to a remarkable extent. In the year 1878 there was only one colony in Britain, and that was on distant St. Kilda, an island group lying some fifty miles west of the Outer Hebrides. Whether the surplus stock originated on St. Kilda itself it is impossible to say, but at the present day the fulmar nests along the coast of Sutherland and Wester Ross; it has established colonies upon Skye and the Outer Hebrides; upon Mull and the small islands lying to the west of Mull. From Mull, or perhaps from Barra Head, it has spread to

Eire, Wales, and even the coast of Cornwall. On the east side of Britain it has spread from the coast of Caithness, by way of Berwick, to Northumberland, and even to Yorkshire beyond. When it is realized that the fulmar lays only one egg in a season, and may not even lay each year, this increase is one of the most remarkable things in the history of British birds.

The common bumble bee is found throughout the West Highlands. It is a strong flier, and I have met with it crossing the summits of the Cuillin range in Skye. From personal observations I know that there is a flight-line of these bees between the mainland and the Isle of Skye across the Sound of Sleat, a distance of some five miles. From observations I believe there is also a flight line, in fine, calm weather, from Humish, the most northerly point of Skye, across to Lewis, a distance of some twenty miles. Bumble bees are strong fliers and I remember only on one occasion seeing them defeated by the power of the wind. I was crossing a long line of cliffs in northern Skye and although the sun still shone the south-east wind was increasing to gale force. The wind struck the cliff, which threw the body of fast-moving air high into the sky. This proved an impassable barrier to the bees. Again and again they essayed to fly out over the cliff, and each time were tossed high into the air and swept back, to fall on the heather in the zone of relative quiet behind the cliff. Here bumble bees were to be seen crawling, exhausted, on the ground. The season was September, when the nights are long and cold, and I often wondered what the fate of these storm-beset bumble bees was.

WHAT THE PLANT DOES WITH ITS MATERIALS*

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PLANTS build up a large variety of organic substances. The aromatic compounds of plants include several anthracene derivatives, such as the principles of madder and of senna, but scarcely any naphthalene compounds are known: vitamin K is one of these. Most of the organic constituents of plants are formed of carbon, hydrogen, oxygen, nitrogen, and occasionally phosphorus, sulphur and selenium. No organic halogen compounds have been found in the higher plants; there is no sound evidence that iodine or bromine is necessary for plants, nor is chlorine apparently essential.

In plants few types of organo-metallic derivatives have been extensively investigated; of these, chlorophyll is the best known. Phosphorus occurs in organic combination in phytin and some other substances. Calcium occurs as pectate and organically bound in agar, yet, generally speaking, the bases are best known in combination with simple organic acids. Iron is essential for plant growth, but beyond saying that it is indispensable for the production of chlorophyll, into the composition of which it does not enter, there is not much that can be said about its role in the plant; nor, except about a very few elements, can much be said regarding the combinations of elements in plants or about the function of their compounds.

* Substance of a lecture given before the London and South-Eastern Counties Section of the Institute of Chemistry, at the Institute on April 15.

Plants have been shown to require, for their proper development, minute amounts of what the agronomist calls 'trace' or 'minor' elements, meaning thereby elements which until recently were not regarded as necessary, or were even regarded as toxic. The list of necessary elements is now long and is growing. The success of grain formation in cereals grown on some copper-deficient soils of Australia depends upon the uptake by the plants of a few grams of copper per acre. Water from a copper still usually contains enough copper to be toxic if the water is employed for solution cultures; the essentiality of copper is thus a matter of micrograms rather than of milligrams per plant.

The discovery of boron as an essential element for many plants originated in the circumstance that at Rothamsted Experimental Station there was an entomologist who wished to make bean plants distasteful to the black 'fly' (aphis) which he was studying. The Botany Department supplied him with some formulæ for water-culture solutions to include several unusual elements of which boron was one. All his plants died except those which had been given boron. This was in 1921. The matter was looked into, and in 1923 Dr. Katherine Warington published the proof of the need of the broad bean for boron¹. It is not given to everyone to found a minor industry with her first piece of research, yet this, in effect, happened in her case. Not only has the agricultural consumption of boron compounds attained considerable dimensions but also the importance of salts of copper, manganese, zinc and other elements as manurial constituents is increasing.

The necessity of zinc for pecan trees on the copper-deficient soils of Florida was discovered owing to a copper solution having been made in a galvanized bucket; only trees treated with this solution (which unintentionally contained zinc) responded². An interesting effect of minor elements was also reported from Florida, where orange trees treated with minor elements in addition to the usual fertilizers suffered much less frost damage than did those receiving customary manuring. This offers an example of the dependence of 'condition' upon nutrition. Some minor elements are important for animals though not essential for the herbage plants, which function simply as vehicles. The uptake of cobalt offers an outstanding example of dependence of animals on the soil via the plant.

Plants can be selective in their uptake of elements. There is geochemical interest in the concentration of mesothorium by a pond plant³. From the point of view of essentiality and uptake, one of the most interesting elements is selenium. Its physiological role has been recognized only in the last decade, owing to the investigation of seleniferous soils. These soils have only a small selenium content, but cover vast areas in North America. Marco Polo recorded poisoning of animals in China which has since been shown to be referable to a seleniferous soil. A similar condition in Ireland remains unexplained⁴.

In their reactions to selenium, plants can be divided into four groups: those which require selenium, those which can tolerate large amounts in their tissues, those which can tolerate small amounts but are poisoned by large amounts (these include crop plants such as wheat), and those which practically exclude it. The last group comprises some native prairie grasses. The first group is formed by some species of the botanically varied genera *Astragalus*, *Onoposis* and *Stanleya*; for these selenium is an