a study of the germination of the seeds of the Scotch broom. Dr. John H. Yoe, of the University of Virginia, $50 for his study of organic analytical reagents. The grant to Drs. Cleveland and Murray will be paid by the American Association for the Advancement of Science, being the amount allotted by that organization to the Virginia Academy of Science for research purposes.

DISCUSSION

THE PRINCIPLE OF "DIVERSIFICATION" IN THE WILDLIFE FIELD

A BALANCED agricultural program must include some of the wild things as well as the traditional cultivated crops. Man, animals, plants, climate and soil are all bound together in a single great system of matter and energy. As Francis Thompson said:

> All things by immortal power
> Near and far,
> Hiddenly
> To each other linked are,
> That thou canst not stir a flower
> Without troubling of a star.

Let us examine the situation a little more closely. We overgraze the watersheds of the plains country during the driest years. In the wettest years, as a direct result, disastrous floods occur on the lower parts of the rivers that drain these areas. In some parts of Europe there has been a great vogue for an even-aged stand of single species of trees. Results: elimination of brush, herbs and grasses, of beneficial insects and of hole-nesting birds, such as woodpeckers. Along with the decrease of friends of the forest has gone an increase in harmful bark-borers and other pests as well as deterioration of the soil and decline of wildlife. Now the tendency is toward restoration, so far as possible, of natural conditions as a practical proposition.

Here is the way things operate with us at present:

So-called "vermin" control sometimes eliminates too many of the flesh-eaters and fur-bearers, cutting down on the possible income from trapping on the farm and bringing new problems in rodent and insect control which the predators formerly helped to keep in line. The fur industry in the United States has declined from a gross total of $500,000,000 in 1929 to $150,000,000 in 1934. Fur on the farm and elsewhere has meant a cash income to farm boys and other trappers of $50,000,000 to $65,000,000 a year.

Rodent control often removes too many of the rodents, taking away the principal food of many rapacious species, and forcing them to turn to game, insectivorous birds, poultry or live stock.

Clean farming removes the brush and weeds along the fencerows and elsewhere, with the result that quail and other game and the fur-bearers find food and shelter much less favorable than would otherwise be the case. Insectivorous birds are reduced, for lack of food and nesting cover, and the supposed beneficial results in insect control may be largely non-existent.

A certain type of silviculture has taken out the hardwoods and alleged weed trees in the interest of releasing suppressed conifers. If a CCC camp girdles the water oaks, post oaks, red oaks, sweetgums, blackgums and hickories, the food for game is substantially reduced, and there is a grave question whether the elimination of these splendid trees, some of the handsomest in the forest, is desirable, even if some of the suppressed loblollies and shortleaf pines may be released.

Maintaining as nearly as possible a natural balance on a piece of uncultivated land or on the borders of cultivated land, for that matter, is the equivalent, in the field of wildlife and natural resources management, of *diversified farming in agriculture*. It is the extension of the principle of diversification to the whole field.

In wildlife management, as in agriculture, the one-crop method of administration is often easier, but is a highly artificialized procedure. It is putting all one's eggs in a single basket—too risky to be recommended as a general practice.

It is much better, say the wildlife specialists, to maintain the land under as nearly as possible natural conditions. Let us paint the picture in bold outlines as it might appear in a Texas pine forest.

We start with a normal stand of trees, mixed pines and hardwoods of various species or, at least, a mixture along the margins. Plenty of brush, herbs and grass appear in and about the clearings. Some of the forest trees are over-mature and some are dead. Some are "weed" trees. The population of song and insectivorous birds is at a maximum, since nest sites are available and a variety of insects and food plants is at hand as a result of the variety of vegetation. The dead branches and standing snags afford abundant sites for the valuable birds that nest in holes, such as the woodpeckers, wrens, bluebirds, sparrow hawks, chickadees and owls, all of which work on insects or rodents that at times may become over-abundant. Game species are present in maximum abundance. The deer have plenty of browse, found principally on the borders of clearings, and an abundance of thicket in which to escape their enemies. The quail find

plenty of legumes and grasses on which to feed. The fur-bearers, the hawks and the owls feed on the rodents, snakes, insects and birds, both game and non-game species. The food of the rapacious species will vary from time to time. If any prey becomes over-abundant, it will receive concentrated attention until its numbers go back to normal.

The presence of rodents and snakes will tend to divert attention from the game. The burrowing species of rodents, worms and insects tend to keep the soil in excellent condition for plant growth. While ill-situated surpluses of game are subject to attack and elimination, the presence of adequate cover and food effectively guarantees the protection of game up to the limit of the carrying capacity of the area. The snakes, hawks, owls and fur-bearers set similar limits to the rodent population, consuming only an ill-situated surplus, but tending to hold the animals very distinctly in bounds.

We have the climate, soil and animal and plant population operating as a balanced enterprise, both biologically and economically. Let us examine some of the economic implications of diversification, as extended to natural as well as cultivated crops.

The trees, of various species, can be cut or used for lumber or wood, on a sustained yield basis.

The game can be taken in season—the luxuriance of food and cover guarantees an abundance; the presence of good escape cover helps to avoid too extreme a harvest.

The fur animals can be trapped when their pelts are prime, providing a further source of income, a much appreciated cash return to farm boys and trappers.

Recreationally the area is a good deal more attractive than any "one species of tree" stand could possibly be. As a site for picnics, camps or outings, it is appealing because of its variety of flowers, berries, shade, trees and game.

Fish are abundant in the streams, as there is ample vegetation to regulate the flow of the water to keep it clear, and plenty of insects and plant life to serve as food and shelter for fishes.

Accelerated erosion is prevented because the protecting mantle of vegetation, from the ground cover up, is that adapted by nature to prevent over-rapid run-off.

The soils, instead of being depleted, are conserved and enriched, not only by the variety of legumes, but by the effects of burrowing rodents, insects, worms, protozoa and bacteria. There is no problem of depletion here, as the whole system is in balance.

The waters, as above indicated, instead of running off in one great flood, are permitted to flow moderately and steadily, accomplishing a maximum of good with a minimum of difficulty.

Insect, rodent and predator problems are reduced—as the enemies of potential pests are all present in normal numbers.

Note that among the essential items in maximum and diversified wildlife production are the weed trees, the miscellaneous brush, the over-mature trees, the standing dead snags, a variety of herbaceous plants, the rodents, the snakes, the insects, the hawks, owls, fur-bearers and predators.

Eliminate any of these natural features and the production of beneficial wildlife may be impaired.

There are exceptions to this ideal situation, of course. The practices recommended for diversified farming may not always work out. Occasionally an unusual combination of climatic and other conditions may result in abnormal numbers of rodents or insects or game, in spite of natural controls. Then man must take a hand, although nature, through quick infection of surplus populations with epizootic disease, concentration of enemies or otherwise, ultimately brings under control species that attain plague status.

Man's own unwarranted interference is by far the most difficult problem. Use of land and resources on a quick-crop-quick-profit basis, rather than on a basis of sustained yield, profoundly and inevitably alters the natural set-up.

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PROTOPLASMIC SPECIFICITY

PROTOPLASMIC specificity of form and of function is undoubtedly to be regarded as the resultant of the interaction of the various components which make up the protoplasmic system. In the egg-cell, the components by whose interaction specificity is expressed are usually named "nucleus" and "cytoplasm." More exactly these components are four: nucleus, cytoplasmic inclusions, ectoplasm and ground-substance.

The important rôle of the nucleus in maintaining morphological specificity is too well known to warrant discussion. Similarly, the evidence for specific chemical structure of nucleo-proteins needs no rehearsal here. Of the cytoplasmic inclusions, the yolk of all eggs of marine animals known to me shows a high degree of specificity. Since my original notice that in eggs of *Nereis* and of *Platynereis* completely reversible hydration reveals that the yolk-sphere is a lipin-protein structure,[1] I have learned that yolk of other eggs has this same make-up. This structure I find is revealed as specific by its mode of water intake

[1] Just, *Anat. Record*, 1925; *Physiol. Zool.*, Vol. 1, 1928; *Protoplasma*, Bd. 10, 1930, p. 24, p. 33.