specifically, what is the effect of introducing the requirement that there be at least two randomly chosen observations in each stratum sampled?

To answer this question, tests were made of cover type estimates. These showed unmistakably that the removal of this requirement and selection of the observations in a systematic manner resulted in gains in efficiency; these frequently amounted to more than 100 per cent.

An understanding of the source of this gain in efficiency rests upon recognizing that the great bulk of the populations sampled, particularly in biological and social-science investigations, are not segregated into well-defined strata that are homogeneous within their boundaries, but, rather, vary continuously in much the same fashion as elevations or fertility levels in a field. Therefore, even though individuals in selected subregions of a population tend to be high, or low, as compared with those in other subregions, it will be found upon investigation that, even within subregions, there will be continuous trends of the variate measured, and that the changes between adjacent subregions is continuous in the transition zone encompassing the subregion boundaries. When this is recognized, it becomes apparent that sampling in many populations in place or time reduces to a problem of estimating the ordinates or the integral of a single-valued continuous curve. It is also evident from this that uniformly spaced observations will yield a better representation of this curve than will observations that are restricted only to the extent that when the range of the abscissae of the curve is divided into $\frac{n}{2}$ equal parts, two of the n observations fall in each part. With this restriction, many of the observations may fall so close together that two or even three observations supply little more information concerning the curve than does a single observation. Upon more thorough consideration it will be evident that the gain in accuracy, as measured by the expected variation among systematic sample totals or means, arises also from a usually high correlation among them. That is, when the results of a single sample, so selected, are available, the results of any other such sample can be predicted with considerable precision.

To furnish an estimate of the precision of this prediction requires obtaining two rather easily calculated statistics, namely, estimates of the error variance of a single observation and of the correlation between the ordinates measured and the ordinates to be predicted. The first is estimated by the residual mean-square error from a polynomial fitted by the method of least squares. Since the observations are evenly spaced and of equal weight, this is most readily accomplished by use of orthogonal polynomials, the fitting process being continued until additional fitted constants no longer reduce the residual mean-square significantly as adjudged by Snedecor's F. To estimate the correlation coefficient, it is necessary to calculate the correlation between observations, in the original sample, that are separated by one unit, two units, etc., and to fit a curve to the observations of the correlation coefficient and the distance between observations. This curve is controlled in that at zero distance the correlation coefficient is equal to one. With the data used in this study, a curve of the form $r = e^{-kd}$ where r is the correlation coefficient, d is the distance and k is an arbitrary constant, was usually sufficient to represent the data. From this curve, which may be converted to a curve of $(1-r^2)$ over distance, the average value of $(1-r^2)$ for all possible systematic samples selected in the same way can be estimated. The average squared error of estimate thus is calculated as $s^2\ \overline{(1-r^2)}$, where s^2 is the residual mean square from the polynomial and $\overline{(1-r^2)}$ is the average $(1-r^2)$ as defined above.

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EXTRA STRONG HELIOTROPIC EFFECT OF NEON LIGHTS

IN Texas there is an annual swarming of insects to city lights, which begins at the time late in August when the first break in the excessive summer heat occurs. During all the rest of the year none of these species are to be seen on the city streets.

Then one evening a few cool breezes arise from the north, and that night countless thousands of flying black field crickets descend on the towns. These last for a few nights, and then disappear. A week or so later a similar horde of small black and narrow hard beetles cover buildings around light fixtures. Later an army of odorous small green bugs descend on the towns. These annually recurring visitations have been noticed with interest by the writer for a great many years. During all these years the concentration of insects around lights varied only with the position and intensity of the visible white light rays emitted by the ordinary street and business illuminations.

In the last few years a striking change has been noted in the objects of their attentions. With the installation of numerous neon lights throughout the business district the insects have almost ignored the ordinary white street lights which formerly were covered with them, and which would be seen first in their flight in from the country, and have collected in vast numbers on the neon signs down town.

This selectivity is shown strikingly where a brilliantly white lighted store shows comparatively few insect visitors and another beside it with neon signs is black with countless thousands.

This preference could hardly be a manifestation of ordinary heliotropism, because many of the white illuminations are much stronger in visible light than those which attract the insects.

One new set of visitors came this year—a great influx of brown moths. Thus far the green bugs have not arrived.

If the insects were mainly of varieties normally attracted by bright-colored flowers, one might assume that the superior attraction rested in the color; but this is not the case, with the exception of the moths.

The idea then occurs that possibly neon lights may emanate invisible rays which connect with the antennae of various insects and pull them to its source. If this be true and the radiations can be identified and suitable projectors manufactured, this might be a solution to the problem of crop pest eradication. It may be that different vibrations attract different species, but the evidence seems to indicate that neon lights give off rays which strongly attract insects of widely different types and that this attraction is many times more powerful than that produced by white light.

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COLOR SYSTEMS

THE Ridgway Colors and Nomenclature have been found quite practical for years by biologists, in particular mycologists and ornithologists, for the description of color and at the present time there are many references to Ridgway in the literature. However, an improved system is desirable as the Ridgway colors alter with age and are not reproducible.

Time and the work of many investigators has now shown that the Munsell Color System and notation of Professor A. H. Munsell is well established.[1,2] While the chips of the Munsell Color Book are not absolutely permanent, they are sufficiently stable to withstand normal usage, and a conversion table has now been published which gives the Munsell colors in terms of the ICI (1931) *xy* coordinate specification system which is based on absolute standards.

The large number of Ridgway color chips have simplified comparison and identification of colors. Although the number of Munsell colors is smaller the arrangement, even in the abridged book of color, makes possible close estimation. The alternative color arrangements of the standard book serve for closer checking.

Field work is facilitated, since the Munsell system is based on three distinct dimensions: hue, gray value and saturation (chroma). This makes possible the broad description of colors without comparison with standards, for the observer can readily indicate the limits of color range when he is doubtful.

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REPRINTS FOR EUROPEAN LABORATORIES

IN SCIENCE for November 7, Robert B. Dean suggests that since European laboratories are unable to obtain American or British scientific journals, reprints be sent by American scientists instead. Such reprints may reach certain laboratories, but not all. Since November, 1940, reprints and personal letters addressed to various scientists in occupied France have uniformly been returned with the notation that service has been suspended. Recently letters to Barcelona have been returned the same way. Reprints and correspondence seem to reach Belgium, Holland and the Scandinavian countries satisfactorily, and also Switzerland. Nothing, however, seems to get into or out of what was Czecho-Slovakia, Poland, Yugoslavia or Greece. There seems little use in wasting funds on shipments of reprints to these portions of Europe if the material is returned due to what appears to be a Nazi policy of intellectual as well as physical starvation.

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QUOTATIONS

A METONIC SPAN IN THE WORK OF THE CARNEGIE CORPORATION

METON was an Athenian astronomer of the fifth century B.C., remembered chiefly because of his division of time into nineteen-year periods. The writer, it must be confessed, first learned of his existence at the recent installation of Dr. John W. Nason as president of Swarthmore College through reference to the Metonic span of nineteen years' service by the retiring president, Dr. Frank Aydelotte. Since his own final report must of necessity deal rather with past experience than with future plans, and since the day of his retirement in November, 1941, also brings to a close a Metonic span in the service of the Carnegie Corporation, the writer has adopted the term as the subtitle of the concluding section of this report.

[1] See the five papers on the Munsell color system and bibliographies as published in *Jour. Opt. Soc. Amer.*: 573–645; December, 1940.

[2] J. J. Glenn and James T. Killian, *Jour. Opt. Soc. Amer.*: 609–616; 1940.