The physiographic investigations made during this survey were published in the Transactions of the Royal Society of Edinburgh in 1892 and 1894 by Dr. H. R. Mill, but the zoological results had never been assembled for publication.

The region surveyed has an area of 1,160 square miles and includes the Arran Basin, the Great Plateau at its mouth, the Estuary of the Clyde, and a series of narrow locks or fiords of which Loch Tyne is the largest. These locks have about 95 per cent. of normal sea water and receive a mean tidal increment of about 4 per cent. of their total volume so that the habitat is typically marine in most essential particulars, but modified by restrictions on circulation and the resulting conditions in temperature typical of fiords.

The seven typical regions are treated separately in the faunistic summaries in which the species are arranged systematically from Protozoa to Vertebrata, with notes on localities, depths and frequencies. All groups are represented except parasitic ones and Protozoa other than Foraminifera, but somewhat unevenly and in the older nomenclatures in some instances. The records are based mainly upon the catches of the dredge rather than those of the plankton net. There are two full bibliographies arranged chronologically and systematically. A grand summary includes 806 species of which only 8 per cent. are found in all of the seven subdivisions. It is highly probable that further explorations will greatly increase the elements of the fauna common to the several subdivisions.

This faunistic study will be useful to American investigators of the North Atlantic fauna as well as to those who will frequent the newly established Bute Marine Laboratory at Rothesay in the Clyde Sea Area, which for research purposes replaces the Scottish Marine Laboratory at Millport, Isle of Cumbrae, which is now in the possession of amateur interests and in the service of more popular aspects of the biological sciences. It is to be hoped that the unparalleled service to marine zoology rendered by Sir John Murray may in time be recognized by a memorial on the shores of Scotland in the form of a marine biological and oceanographical research station whose equipment and work will be worthy of the name it should bear.

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THE ECOLOGICAL SOCIETY AND ITS OPPORTUNITY

Perhaps no other scientific body in this country has the opportunities for cooperation possessed by the Ecological Society. Its membership is made up of workers in zoology, botany and forestry; its field is no less than the relation of all life to its environment. Last summer five members of the Ecological Society, representing zoology, botany and forestry, camped together near the summit of Mt. Marcy in the Adirondack mountains of New York for the purpose of doing a concrete piece of cooperative research on the plants and animals at timber line, and to bring together into a list some of the problems in ecology. The persons and institutions cooperating were: Barrington Moore, president of the Ecological Society, Norman Taylor, for the Brooklyn Botanic Garden, George P. Burns for the Vermont Agricultural Experiment Station, Charles C. Adams and T. L. Hankinson for the New York State College of Forestry at Syracuse.

The results of the study at timber-line will be published elsewhere. The list of problems is given below. The list is by no means all inclusive, nor does it attempt to be thoroughly logical. It states general problems, with their subdivisions, and gives also a number of specific problems which in reality form parts of general problems. The purpose of this list is threefold: (1) to show gaps in our scientific knowledge, or subjects in which the fundamental facts needed for further human progress are lacking; (2) to show subjects in which cooperation is essential, subjects which a given science can carry only to a certain point and which must be taken up by one or more other sciences for solution; (3) to suggest specific problems for research workers and students.

GENERAL PROBLEMS

I. Factors influencing the distribution of land plants and animals.
- (1) Geographic position.
- (2) Altitude. How far does altitude per se influence distribution?
- (3) Topography.
  - (*a*) Aspect, steepness of slope, valleys, benches and other land forms.
  - (*b*) Influence of size of land mass of mountains, *i. e.*, isolated mountains *vs.* mountain masses.
  - (*c*) Influence of water masses.
- (4) Historical factors.
  - (*a*) Physical (geology, past climate).
  - (*b*) Biotic.
- (5) Climate.
  - (*a*) Moisture.
  - (*b*) Temperature.
  - (*c*) Solar radiation or insolation.
  - (*d*) Light.
  - (*e*) Wind.
- (6) Soil.
  - (*a*) Physical properties.
    1. Texture, desirability of a physical constant: is wilting coefficient such a constant?
    2. Soil moisture.
    3. Soil air.
    4. Soil temperature.
    5. Soil stratification or profile.
  - (*b*) Chemical properties.
    1. Solutions.
      - (*a*) Aqueous extracts (correlations with fertility.
      - (*b*) Acid extracts.
      - (*c*) Full analyses.
    2. Gases. Chemical properties of soil air.
  - (*c*) Biotic properties. All life plant as well as animal, influencing the soil.

II. Factors influencing the distribution of aquatic plants and animals.

A. Standing water.
- (1) Geographic position.
- (2) Altitude.
- (3) Depth, and fluctuations of depth.
- (4) Historical factors.
  - (*a*) Physical (geology, past climate).
  - (*b*) Biotic.
- (5) Climate.
  - (*a*) Temperature.
  - (*b*) Solar radiation or insolation.
  - (*c*) Light.
  - (*d*) Wind. Important in aeration of water.
- (6) Water solution.
  - (*a*) Color and turbidity.
  - (*b*) Mineral and organic content.
  - (*c*) Gaseous content.
- (7) Biotic factors.
- (8) Bottom.

B. Running water.
- (1) Geographic position.
- (2) Altitude.
- (3) Fluctuation.
  - (*a*) Whether it fluctuates at all (streams on east slope of Cascade Mts. of Oregon do not fluctuate).
  - (*b*) Extent of fluctuation.
  - (*c*) Period of fluctuation (diurnal or irregular).
- (4) Swiftness.
- (5) Depth.
- (6) Historical factors.
- (7) Climate.
  - (*a*) Temperature.
  - (*b*) Solar radiation or insolation.
  - (*c*) Light.
  - (*d*) Wind.
- (8) Water solution.
  - (*a*) Color and turbidity.
  - (*b*) Mineral and organic content.
- (9) Biotic factors.
- (10) Bottom.

III. Studies of factors influencing distribution. (A suggested method of procedure).

A. Field survey of the problem.
- (1) To determine significant associations of plants and animals.
- (2) Determination of center and extremes (northern and southern, or east and west, or upper and lower in altitude).
- (3) Instrumental readings at each of the above points, and their interpretation.

B. Laboratory studies.
- (1) Growth under controlled conditions (with recording instruments if possible).
- (2) Analysis of critical effects.

(3) Determination of specific requirements.

C. Field interpretation of laboratory results. (In the case of temperature this will probably mean remeasurements unless recording instruments have been used.)

IV. Studies of plants and animals at the edges of their ranges. Determination of the environment at the edge of the ranges of plants and animals should help to give, for the different environmental factors, the limits within which individual species of plants and animals can grow.

V. Ecological differentiation in plants and animals, structural and functional.

(*a*) Ecological differentiation in single species.

(*b*) Growth forms and regional distribution. Frequency of occurrence and abundance, correlated with environmental factors.

VI. Migration of plant and animals.

(1) Wind.
(2) Animals.
(3) Water.
(4) Free movement of organisms.
(5) Landslides and avalanches.
(6) Movement of environment.

VII. Relation of present plant and animal life to past floras and faunas.

(1) In unglaciated regions.
(2) In glaciated regions.
(3) Post-glacial changes.

VIII. Origin and composition of organic soils. Includes forest soils, humus, peat, muck, etc.

IX. Studies of soil organisms. Bacteria, nematodes, fungi and other organisms.

SPECIAL PROBLEMS

X. Relation of osmotic pressure to elongation.

XI. Relation of temperature to root absorption.

XII. Seasonal rhythm in organism, *e. g.:*

(1) Resting period.
(2) Photosynthesis of evergreens in winter.

XIII. Relation of mycorrhiza to root hair development. (Part of general problem of symbiosis.)

XIV. Composition of light under forest canopies. Is this diffused light or light of different composition?

XV. Effect of shade on chlorophyll content.

XVI. Water requirement of forest trees.

XVII. Nutrition of forest trees. Influence of various kinds of soils.

XVIII. Minimum requirement of solar energy for tree seedling growth or leaf development.

XIX. Factors controlling the natural pruning of forest trees.

XX. Factors controlling the non-periodic shedding of the leaves of forest trees.

XXI. Study of seed bed in forests under natural conditions, in relation to germination and establishment; comparison of seed bed in forests with nursery seed beds.

XXII. Sensitiveness of roots of different species to: (*a*) lack of oxygen, (*b*) soil acidity, and (*c*) soil alkalinity.

XXIII. Studies of fungi in forest soils.

(1) With relation to rendering nutrients (chiefly nitrogen) available to plants.
(2) With relation to soil reaction (acidity or alkalinity).
(3) Influence on ventilation.
(4) Effect on plant roots.

XXIV. Selective absorption of roots in soil.

(1) Under different soil moisture conditions.
(2) Under different atmospheric conditions.

XXV. Pull exerted by roots in withdrawing water from soils under different moisture conditions. Influence of atmospheric conditions

Barrington Moore,
Chairman Committee on Cooperation

THE CANADIAN BRANCH OF THE AMERICAN PHYTOPATHOLOGICAL SOCIETY

The first annual meeting of the Canadian Branch of the American Phytopathological Society was held at the Ontario Agricultural College, Guelph, Ontario, December 11 and 12.

Canadian phytopathologists were well represented at this meeting. Among those taking active part in the proceedings were: Dr. A. H. R. Buller, University of Manitoba; Dr. J. H. Faull, Toronto University; Mr. P. A. Murphy, Dominion Laboratory of Plant Pathology, Charlottetown, P. E. I.; Mr. W. H. Rankin, St. Catharines; Mr. W. P. Fraser, Saskatoon, Sask.; R. J. Blair, Forest Products Laboratories, Montreal; Mr. F. L. Drayton, Central Experimental Farm, Ottawa; Professor L. Cæsar, Professor J. E. Howitt and Dr. R. E. Stone, Ontario Agricultural College.