Darwinism in forestry / Raphael Zon.

The statement to which Darwin referred in his letter to Hooker appeared in the *Gardeners' Chronicle* on April 21, 1860 (page 362), and is this:

I have been much interested by Mr. Patrick Matthew's communication in the number of your paper dated April 7th. *I freely acknowledge that Mr. Matthew has anticipated by many years the explanation which I have offered of the origin of species, under the name of natural selection.* I think that no one will feel surprised that neither I, nor apparently any other naturalist, *had heard of Mr. Matthew's views,* considering how briefly they are given, and that they appeared in the *appendix to a work* on *Naval Timber and Arboriculture.* I can do no more than offer my apologies to Mr. Matthew for my entire ignorance of this publication. If another edition of my work is called for, I will insert to the foregoing effect.[3]

In the Historical Sketch[4] which he added to the later editions of his book Darwin gives Matthew credit for the Nature's law of selection in the following words:

In 1831 Mr. Patrick Matthew published his work on "Naval Timber and Arboriculture," in which he gives precisely the same view on the origin of species as that (presently to be alluded to) propounded by Mr. Wallace and myself in the *Linnean Journal,* and as that enlarged in the present volume. Unfortunately, the view was given by Mr. Matthew very briefly in scattered passages in an Appendix to a work on a different subject, so that it remained unnoticed until Mr. Matthew himself drew attention to it in the *Gardeners' Chronicle,* on April 7th, 1860. The differences of Mr. Matthew's view from mine are *not of much importance:* he seems to consider that the world was nearly depopulated at successive periods, and then re-stocked; and he gives as an alternative, that new forms may be generated "without the presence of any mould or germ of former aggregates." I am not sure that I understand some passages; but it seems that he attributes much influence to the direct action of the conditions of life. *He clearly saw, however, the full force of the principle of natural selection.*[5]

In a letter written by Darwin to J. L. A. de Quatrefages on April 25, 1861, he referred to Patrick Matthew's explanation in a postscript as follows:

I have lately read M. Naudin's paper, but it does not seem to me to anticipate me, as he does not show how selection could be applied under

[3] *Ibid.*

[4] "The Origin of Species," 1878, p. xvi—Historical Sketch.

[5] *Ibid.*

nature; but an obscure writer on forest trees, in 1830, in Scotland, most expressly and clearly anticipated my views—though he put the case so briefly that no single person ever noticed the scattered passages in his book.

Grant Allen in his biography of Darwin (1888) calls Patrick Matthew the unconscious author of the principle of natural selection which he applied in his book on naval timber to the entire Nature.

Here then is a most interesting fact which seems to me of deep significance to foresters. The first Darwinian, who twenty-nine years before Darwin formulated the law of natural selection, was a forester. I shall not attempt here to compare Darwin's and Matthew's views on natural selection. Matthew's book, the full title of which is "Naval Timber and Arboriculture, With Critical Notes on Authors Who Have Recently Treated the Subject of Planting," is accessible in the Congressional Library. The chapter on Nature's Law of Selection I hope can be reprinted in the next issue of the *Proceedings of the Society of American Foresters,* so that every one will be able to draw the comparison for himself.

In bringing together this evidence I am very far indeed from any desire to detract in the least from the great service which Darwin rendered to science. It was Darwin who first gave flesh and blood to the idea of natural selection. It was his wonderful interpretation of all biological facts in the light of natural selection that made the latter the universal law applicable to the entire organic world. Before this accomplishment the claims of all others must sink into obscurity.

My purpose in assembling these records is twofold: *First,* to restore the memory of one who ploughed the same fields as we do now, the name of a forester whose idea, although it did not perish, slumbered almost unknown for nearly thirty years until another and bigger man brought it to life and general recognition; and *second,* to offer an explanation of the reason why a forester above all others should be the one to observe and formu-

late the law of the struggle for existence as the basis for natural selection and the origin of new species.

My first purpose, I hope, has been accomplished by quoting extracts from Darwin's correspondence. The second still remains.

There is nothing accidental, in my opinion, in the fact that a forester should be the first to observe the struggle for existence and its bearing upon the development of the new varieties, because there is no other plant society in the world which presents a more striking example of the struggle for existence and of natural selection than the forest. Nowhere else, also, can the law of this process be more fully studied.

The regular decrease in the number of trees on a given area with increase in age forms one of the earliest observations of the foresters, who, at a time antedating Darwin, properly gave this process the name of the struggle for existence, the struggle for the necessary growing space. The foresters have discovered the laws governing this process, a process in which almost 95 per cent. of all trees that start life in the stand perish, and in the form of yield tables have expressed it quantitatively, have measured and weighed it. They have shown how this struggle for existence varies with the species, climate, drainage and soil conditions, and age of the stand; that it is more intense, and consequently the differentiation into dominant and suppressed classes occurs earlier with light-needing species than with shade-enduring ones. In a climate most suitable to the species and on favorable situations this struggle again results in more rapid differentiation into dominant and suppressed trees than when the species grow outside of their optimum range and on poor soils. These are elementary and fundamental facts known to foresters for many years.

The foresters have not only observed these facts, but they have also furnished an explanation for them. The more favorable the conditions of growth, the greater is the development of the individual trees; the earlier,

therefore, begins the struggle for space and the differentiation into dominant and suppressed, with the subsequent dying out of the latter. They have followed this process throughout the entire life of the stand, have established its various degrees of severity, and have discovered its culmination during the period of the most rapid growth in height. This struggle for space and light is the basis of the forester's operations, as only by utilizing and controlling it is he capable of producing wood of high technical qualities, tall cylindrical boles, free of branches, and wood with uniform annual rings possessing great elasticity. Without this struggle there is no forest, there is no production of valuable timber, save firewood.

The struggle for existence in a forest stand is not confined to individual members of the same age or the same story, but the forest, as a whole, battles for its existence against the adjoining meadow, swamp or shrub vegetation; the old trees against the young growth that comes up under them; groups of trees of different species or of different ages against each other. In this struggle the forest accomplishes what no other vegetation does; namely, it actually changes the climate over the area occupied by it, and makes it inhospitable for its enemies. The forest creates its own interior environment to which its own members are completely adapted, but in which other species find either too much or too little light, the humus too scant or too deep, or too acid, the temperature too high or too low. Whatever it may be, the forest's competitors are eliminated through the changed environment. To change this environment, however, there must be a close stand, there must be present the struggle for existence among the individual members of the stand. Through interior struggle among its own members the stand secures resistance against invasion by other vegetation. How manifoldly broad and deep, then, is the struggle for existence in the forest.

When we come now to natural selection nowhere else is

it expressed in such fullness and so strikingly as in the forest. The forest is a natural breeding place in which constantly only the trees best adapted to the climate and the situation are allowed to remain. In the forest only the conquerors in the struggle for existence are the ones which produce seed in abundance. During a seed year the dominant and co-dominant trees produce seed in large quantities; the intermediate trees, which may properly be called the candidates for suppression, participate but little, and then only in exceptionally good seed years, while the oppressed and suppressed do not bear seed at all. With what rigidity, then, must the natural selection go on in a forest, if we consider *first* what a small percentage of trees in a stand of the same generation come to be conquerors in the struggle for existence; *second,* the great age reached by trees; *third,* the numerous generations of trees that have succeeded each other in the same forest; and *fourth,* the relatively limited capacity of tree seeds for dissemination. With each generation the forest trees must become more and more delicately adjusted and adapted to the given conditions of growth. The new generation inevitably arises from seed sown by the best developed trees, from those which have withstood the long and intense battle not only against Nature alone, but against Nature in the presence of competitors. Of this possibly only 1 per cent. or less will reach maturity and be able to continue the species. No wonder, therefore, that in spite of search for new species all over the world so few forest trees have been successfully introduced into new countries and so little progress has been made with the artificial improvement of them. So perfect is the natural selection in the forest, so fine is the adjustment between the environment and the forest trees, that it is almost impossible for man to approach it. I do not mean the introduction of trees for park purposes or breeding new varieties for some other purpose than timber; I have in mind only the establishment of natural forests and the production of timber.

The natural selection forms also the basis of the forester's operation in selecting trees for seeding purposes, in making regeneration cuttings, in collecting seed for reforestation and so on.

These few facts are enough to show with what fullness and force the principles advanced by Darwin are expressed in the forest. If agriculture furnished Darwin with many examples of artificial selection upon which he built by analogy his principle of natural selection, the forest, of all plant formations, furnishes the most striking examples and proof of the latter. *As a matter of fact, forestry as an art is nothing else but the controlling and regulating of the struggle for existence for the practical ends of man; forestry as a science is nothing else but the study of the laws which govern the struggle for existence.*

Is there anything strange, therefore, that it was a forester who first formulated the principles of natural selection? Is there anything strange, also, in the fact that it was also foresters who have laid the foundation for what has come to be known as ecology, which is the logical development of Darwinism? Because of the fact that the forest is the highest expression of plant life, the foresters occupy the strategic position from which they command vistas accessible only with difficulty to other naturalists. In this lies the strength of forestry, its peculiar beauty, and the debt which science owes to it.