

## NOTES ON THE NATURAL LIMITS TO OCCUPATION ON THE LAND.

By R. M. JOHNSTON, F.L.S.

The number of persons that may be employed upon the land varies with the country, with the form of cultivation, and with the degree of civilisation. But whatever the civilisation may be, there are natural limits to occupation on the land which bar the introduction of more than a certain number. The natural conditions which principally determine these limits are:—(a.) The total extent of land surface of the particular country. (b.) The degree of fertility and the extent of land open to hunting wild animals, or gathering natural vegetable roots or fruits; cultivation for pasturage only; cultivation for either crops or pasturage. (c.) Knowledge and capital as factors in determining and employing the best methods for extracting the greatest amount of produce from a definite area. (d.) The absolute number of hands necessary to cultivate a given area in any form, beyond which limit human labour is wasted in fruitless effort or in positive idleness. (e.) The proportion of cultivable area already occupied. If, in addition, we employ the indices  $m$ ,  $e$ , and  $n$  as indicating maximum, medium, and minimum of each condition, we may express by simple formulae the conditions which determine the largest ( $D^m$ ) and smallest ( $D^n$ ) number of hands which can find occupation on the land; always assuming that their time is wholly occupied within the field of their own division of labour.

We are now able to express definitely the conditions which determine the *maximum* ( $D^m$ ), *medium*, and *minimum* ( $D^n$ ) number of hands that it would be necessary to employ upon the land according to the existing conditions under which agricultural and pastoral pursuits are carried on in the United Kingdom.

The Maximum number of hands employed upon the land could only occur under the following conditions:—

$$A^m \times B^m \times C^m = D^m$$

The Minimum number could alone be employed under the opposite of this condition, viz.:—

$$A^n \times B^n \times C^m = D^n$$

But it never happens that a country as a whole can devote all its cultivable lands to one form of cultivation, say, crops

from tilled lands. The following proportions show what obtains in five great countries in Europe:—

PROPORTION PERCENTAGE TOTAL AREA IN CULTIVATION.

—	Tillage.	Pas-turage.	All culti-vated.	Hands per 100 acres in cultivation.
United Kingdom ...	43·56	56·44	100·00	5·38
France ...	86·96	13·04	100·00	7·17
Russia ...	39·23	60·77	100·00	7·88
Germany ...	58·40	41·60	100·00	12·19
Belgium ...	82·46	17·56	100·00	17·91
Five Countries ...	53·79	46·21	100·00	8·22

From this analysis we can perceive that there is a variation in the hands employed per 100 acres, ranging between 5·38 per cent. in the United Kingdom to 17·91 in Belgium. The tilled lands requiring a larger proportion of hands, account for the larger number employed per 100 acres in some countries; but against this must be placed the reduction in the hands employed, effected by the introduction of machinery and improved methods of culture—when all other things are equal. The space limit to occupation on the land, however, can only affect countries that are already densely populated and whose land area relatively is limited. Let us, therefore, apply this method to a particular country, say, the United Kingdom, for the purpose of ascertaining:—

1. The maximum number of hands that could find employment upon the land, supposing it was conceivable to bring the total area into cultivation.
2. The maximum number that could find employment on the more probable supposition that only 75 per cent. of the area could possibly be utilised.
3. The number of years in which the full limit would be reached supposing it conceivable to cultivate the whole area of the country including sites of dwellings in towns, villages, and cities, and lake and mountain areas.
4. The number of years in which the full limit would be reached, supposing it probable that no more than 75 per cent. of the total area could be brought under cultivation.

Then let  $A$ =Total area in acres = 77.80 million acres.

$H$ =The number of hands required to cultivate each 100 acres according to existing conditions=5.35 hands.

$R$ =Average natural rate of increase of Rural Population=say 1.25 per year.

$C$ =The actual area already in cultivation in (1840)=43.80 million acres.

$N$ =The number of hands already employed in 1840 in cultivating the land=3.400 million hands.

$N^a$ =Ditto ditto in 1881=2.561 million hands.

The answers to queries 1, 2, 3, and 4 would be as follows:—

$$\text{Query (1.) } \therefore \frac{AH}{100} = X \text{ or max. number of hands or} \\ = \text{Ans. (1)} = 4.162 \text{ millions.}$$

$$(2.) \therefore \frac{\left(\frac{75}{100} A\right)}{100} \times H = Y \text{ or max. number of hands,} \\ \text{or} = \text{Ans. (2)} = 3.122 \text{ millions.}$$

$$(3.) \therefore \frac{\log. X - \log. N}{\log. R} = \frac{\log. 4.162.000 - \log. 3.400.000}{\log 1.25} \\ = 16.28 \text{ years or year 1856.}$$

$$(4.) \left\{ \begin{array}{l} \therefore \frac{\log. Y - \log. N^a}{\log R} = \frac{\log. 3.122.000 - \log. 2.561.000}{\log. 1.25} \\ = 15.94 \text{ years, or year 1896.} \\ \therefore \frac{\log. X - \log. N}{\log. R} = \frac{\log. 4.162.000 - \log. 2.561.000}{\log. 1.25} \\ = 39.09 \text{ years, or year 1929.} \end{array} \right.$$

It has thus been demonstrated that the ordinary growth by natural increase of the agricultural population of the United Kingdom of 1841 (if migration was prevented by placing them on the land still uncultivated) would fully stock the whole of its land area of every description in 16.28 years later; that is in the year 1856, or 36 years ago. Starting with the agricultural population of 1881, the same rate of natural increase, under similar conditions, would fully stock 75 per cent. of its land surface in the year 1896, or four years hence; and even if we conceive what is impossible, that its total area was open to cultivation, this same natural

increase would fully stock land occupations in the year 1920.

It is clear, therefore, that employment on the land in the United Kingdom is bound in within very narrow limits by space—one of the most formidable of all natural limits—and no alteration in the rate of remuneration of the agricultural labourer, nor improvement in his condition, can affect this limit in the slightest degree. But in addition to the space limit, the number of hands necessary to cultivate a given area, or produce a definite quantity of produce, there is a gradually contracting limit brought about by natural forces, such as steam, electricity, and improvements in labour-saving machinery. Thus the same area in 1881 was cultivated in a higher degree, and with better results, than in 1841, with a reduction in the hands employed equivalent to 31·06 per cent. Since 1841 the added force of steam, as an auxiliary to human labour in the United Kingdom alone, and there utilised in the transport of materials and in various other ways, is estimated to be equivalent to the manual force of 103 millions of workmen, or fully six times the manual force of the total number of breadwinners of the United Kingdom at the present moment. It is not surprising, therefore, that agricultural hands per 100 acres should have decreased from 7·76 in 1840 to 5·35 in the year 1881; and that these combined causes should of necessity compel a regular stream of migration from rural districts to urban centres or to other countries; and so long as a healthy condition exists in rural districts (unmistakably indicated always by a high rate of natural increase) such migration is inevitable. According to calculations made by Mr. Mulhall, in the United States 9,000,000 hands raise nearly half as much grain as 66,000,000 hands in Europe. Thus it appears that for want of implements or proper machinery there is a waste of labour in Europe equal to 48,000,000 of peasants. In other words, one farm labourer in the United States is worth more than three in Europe. This state of affairs in Europe, however, is altering for the better each year. Since 1840, owing to improvements in implements and machinery, tillage has become more productive, and grain has become cheaper. From the same authority we learn that "in 1840 each peasant produced about 75 bushels of grain; in 1860 the average was 87, and in 1887 it had risen to 114; that is, two men now produce more grain than three did in 1840." From these observations we are able to understand that a smaller number of hands employed in agriculture is no indication of smaller produce. Take the results of two periods in the United Kingdom, 1840 and 1887, and we at once perceive that the tendencies upon the whole are beneficial—not injurious.

--	1840	1887	Percentage Increase or Decrease since 1840.	
			Increase.	Decrease.
Total population Millions No.	26.71	57.08	38.86	—
Agricultural hands „ „	3.40	2.56	—	24.70
Other occupations „ „	7.96	14.16	77.89	—
Total acreage under crop „ Acres	22.00	21.00	—	4.55
Total under all forms of cultivation „ „	43.80	47.88	9.19	—
Agricultural capital per hand „ „ £	579	893	54.23	—
Agricultural products per hand... „ £	65	97	49.23	—
Agricultural hands per 100 acres in crop... „ No.	15.45	12.19	—	21.10
Ditto per 100 acres in total cultivation ...	No. 7.76	5.35	—	31.06
Wheat consumed per head ... lbs.	255	354	38.82	—
Meat consumed per head ... lbs.	87	109	25.29	—
Price of wheat per ton £	16.60	8.15	—	50.90
Capital wealth ... millions £	4,100	9,400	129.30	—
Horse-power of steam used as a motive power ... No.	600,000	9,200,000	1,433	—
Paupers per 1,000 persons ... No.	57.40	25.80	—	55.05

Nothing could more plainly reveal the general tendency of modern agriculture than these figures. It shows clearly, so far as the United Kingdom is concerned, that progress in improved modes of cultivation means:—Increased capital, increased products, cheaper food, increase of hands in other occupations, and a gradual decrease in the hands employed in agricultural pursuits, associated with a general decrease in the amount of pauperism. Employment upon the land, therefore, is lessened relatively by every advance made in the modes of culture, and is blocked absolutely so far as many populous countries are concerned by limits of space available for cultivation of any kind. Unless, therefore, a country like the United Kingdom takes a backward step in mode of cultivating the land, she cannot, while foreign products are of necessity admitted freely, place more than 5.35 hands upon each 100 acres in cultivation. No legislation under such conditions, made with the view of giving facilities for land ownership, can affect the numbers that may be employed. It is conceivable that the lot of the worker may by such means be ameliorated or improved, but legislation within a freetrade border cannot enlarge the field of employment for the agricultural labourer. Nor under any circumstances

whatever can legislation increase the number of agricultural hands without loss and injury to the people as a whole.

In conclusion, let me not be supposed to indicate by these observations that the lessening numbers of persons employed on the land in such a country as the United Kingdom is to be regarded as a matter to be deplored. On the contrary, I regard it as an index of advance in civilisation. If the food and raw products necessary for man's needs and satisfactions could be miraculously produced without the agency of a single labourer, mankind would be enriched, not impoverished; for there would then be so much more labour force available for the creation of comforts and satisfactions, in such cheapness and abundance, that all men might possess and enjoy them in a degree now only possible to a few rich individuals. What is wanted, therefore, in countries passing through a transition of the kind referred to is, not to place any check upon free migration and other movements which now act as safety-valves to congested fields of labour, but rather to increase the facilities for transfer from those places and those occupations where pressure of competition for employment is greatest. It is the obstruction which natural and artificial barriers offer to transfer from blocked areas and blocked occupations that causes the so-called congestion of labour in crowded centres of population, and any discovery which would remove such barriers would mark a new era in the progress of civilised communities.

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### DISCUSSION.

Hon. N. J. BROWN, in speaking to the paper, said he could not presume to criticise the able and interesting paper they had just listened to. He would like to read it carefully before making any remark upon it, but as he had been invited to open a discussion of it, he would venture to express one or two ideas that had occurred to him on the spur of the moment. There was just one point which it seemed to him Mr. Johnston had rather omitted to give prominence to, and that was the competition which a country like Great Britain, and he might say other European countries also, had to contend with, more especially in recent years, by the employment of labour sustained at a very small expense as compared with the labour in the countries he had more especially dealt with. Any change in the direction of increased cost of production of cereals abroad would surely increase the quantity that could be profitably produced at home; and, consequently, the number of people employed in such production. There was no doubt, looking at the matter broadly, that there was

prevalent a very great delusion in the minds of very many people who were not acquainted with the conditions under which land was cultivated as to the extent to which it might be profitably occupied, and if so far the paper read would have the effect of dissipating that illusion, he was quite sure Mr. Johnston would have done good service not only to this community, but to other communities also. There was no doubt a feeling abroad which was expressed by a prominent politician some two or three years ago that the salvation of the working population of Great Britain might be worked out by presenting each labourer with three acres and a cow, and he thought that one object of the paper was to some extent to remove delusions such as that from the popular mind. They knew that in this colony in past years it had been exceedingly profitable for people to take up 200, 300, or 400 acres, and devote themselves exclusively to the cultivation of grain. But other conditions had now come in with the cultivation of the soil in the other colonies, and therefore they found a great deal in what Mr. Johnston had said which could be brought home to themselves. One other point he would like to mention in connection with this subject. He referred to the fact by the increase of population it is estimated by a reliable authority the world required annually an increase of 30 millions of bushels of wheat, and as the production of wheat was gradually falling off, owing to the continued reduction in price, it was thought by those competent to judge that within the next few years there would be a considerable increase in the price of wheat. If that were so, and the calculation he had mentioned rested upon a solid foundation, it certainly must to a very considerable extent modify the views which Mr. Johnston and others took as to the prospects of the cultivation of land for the production of cereals even in the United Kingdom. He would only add that their cordial thanks were due to Mr. Johnston for introducing the subject to their notice, and for the manner in which he had dealt with it.

Mr. JOHNSTON pointed out, in reply, that what he spoke about was the natural limits to the occupation of the land. Of course, the space limit could not apply to these colonies, and he hoped it would be very long before it could apply here. It was in England, and places of a like nature, in which the space limit, as a factor, comes immediately into operation in determining the number of hands that may be employed on the land. With regard to the proposals to give each agricultural labourer a bit of land to cultivate for himself, and so augment his income obtained otherwise by working for large farm employers, he hoped it might ameliorate his condition, but he feared that he could not permanently retain this advantage, as the tendency of competition would

make this very advantage a lever to depress ordinary wages.

HIS EXCELLENCY, in moving a vote of thanks to the gentlemen who had contributed papers, said he had listened to very many interesting papers, but he did not think he ever listened to any paper with such interest as the one delivered by Mr. Johnston. It was a subject he had thought a good deal on himself. He had never heard or seen it treated in the same way as Mr. Johnston had done, and he hoped when completed the paper would have a very wide circulation indeed. In an article in a recent number of the *Nineteenth Century*, Mr. Johnston referred to the point slightly; but he had dealt with it that night in such a strong way that he had really advanced the scientific basis of the subject. Of course, there was a great deal to be said on the other side; but he held that Mr. Johnston had really taken a step forward in the consideration of the subject. As regarded Mr. Taylor's paper, he was sure they had all listened to it with great interest. The explanation he had given was very clear, and he had no doubt his object would be fulfilled if the general attention of the mining public was directed both to the advantages and drawbacks of this description of timbering. (Applause).