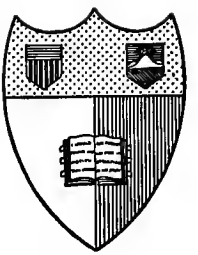
THE RESTORATION OF AGRICULTURE IN THE FAMINE AREA OF RUSSIA



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BEING THE INTERIM REPORT OF THE STATE ECONOMIC PLANNING COMMISSION OF THE COUNCIL FOR LABOUR AND DEFENCE OF THE RUSSIAN SOCIALIST FEDERAL SOVIET REPUBLIC

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FOREWORD

THE agriculture of south-eastern Russia, affected during the current year by a failure of the crops unprecedented in its severity, has received a staggering blow. The extent of the crisis and its extraordinary acuteness are partly due to the drought of this year, but are partly dependent upon social and economic conditions. The south-eastern area is a typically arid one. It contains a vast extent of cultivable land. Good harvests in favourable years, and a vigorous demand for cereals (especially for wheat), have, in conjunction with the foregoing circumstances, promoted the development of an unstable system of peasant agriculture, of the extensive type, and characterised by an extremely low level of agricultural technique.

Wheat is here the main crop (55 per cent.). In the region of the steppes this harvest is dependent upon the rainfall of two months—May and June. The unintermittent succession of wheat crops has exhausted the soil, and has led to so terrible a contamination of the peasant sowings that the yield has been reduced from a possible 92 per cent. to 46 per cent.[1] The conditions under which the land is exploited are extremely unfavourable to the progress of agriculture. The villages in the Volga region are excessively large, or rather, such large villages form 70 per cent. of the total. As a result, many of the fields are a long way from the villages, sometimes ten miles or more. There have been frequent redistributions of land among the peasants, and these redistributions have caused economic instability in the utilisation of the soil, with all that this instability entails. The lack of the most elementary improvements in agrarian technique, and the lack of any organised assistance to the agricultural population, have likewise influenced the general economic level of the area. Such have been the leading features and conditions of peasant farming in the arid South East.

[1] S. Bazhanoff, Observations on contaminated Vegetation. made in the Year 1913 in the Buzuluk experimental Field and in its Neighbourhood (Samara Province).

After the revolution, the farming of the South East deteriorated even more. Gravely affected by the world war, it was then still more gravely injured by the civil war and by the economic blockade of Russia. For a considerable period, the South East was the arena of fierce struggles between the Red Army and the enemies of the working population. Thereby peasant farming was completely disorganised. The civil war continued on other fronts, so that the peasants of the South East were compelled to devote all their energies to the aid of the Republic and the Red Army, and this led to a still further diminution of the productive and victualling resources of the South East. Finally, the discontinuance of the importation of agricultural implements and machinery which was a consequence of the blockade rendered the restoration of peasant farming quite impossible. The disrepair of farming implements and machinery has now reached catastrophic proportions—50 to 70 per cent. Such have been the causes of a great decline in the extent of land sown in the area now affected by the failure of the crops, and such were the causes of the reduction in the number of farm beasts. In 1921, as compared with 1916, the area sown has been reduced to 37 per cent., the number of draught beasts to 46 per cent., and the number of cows to 30 per cent. The reduction in the sown area was even greater than this in Lower-Volga, which is ordinarily more productive.

Such was the condition of rural economy in the South East when the terrible blow of the drought, with the consequent famine, was superadded.

In the above-described natural conditions of the area, and in the way in which its rural economy is organised, we discern, not merely the essential causes of the present distress, but also the essential preliminaries to the correct formulation of one of the chief problems which has to be solved in the economic life of our Republic, namely, the restoration and the further development of the farming and of the productive forces of the South East. The Soviet Power cannot rest content with furnishing direct relief to the hunger-stricken population. It would be impossible to abandon the peasantry of this area, which has been ruined by failure of the crops and by famine, to the slow processes of a protracted restoration, without any decisive and purposive economic aid from the State. The economic life of the South East has been shaken to its foundations, and the interests of the Republic

imperatively demand that the restoration shall be as speedy as possible. Nor is this all. The Republic must perseveringly devote its energies to a difficult task, must grapple with this problem of drought in a way that will render impossible any recurrence of the misfortune from which the provinces of Mid-Volga and Lower-Volga are suffering at the present time.

The South East contains enormous natural resources. If the problems above outlined are satisfactorily solved, it will become a granary, not merely for the Republic, but to a great extent also for the industrial regions of western Europe. Furthermore, it will prove a valuable source of other important products of husbandry and stock-raising, and also of the fishing industry.

The amount of territory in which the crops have failed extends (without including Uralsk province) to 56,400,000 desyatinas.[1] Its population is 19,000,000, which comprises one-seventh of the population of the Republic. The average annual export of grain from this area during the years 1909–1913 amounted to 188,000,000 poods, being 24 per cent. of the total Russian grain export; and 65,000,000 poods of grain, or 35 per cent. of the surplus grain production of the South East, went to the foreign market. The importance of this area in the general economic life of the country has led the State Economic Planning Commission of the Council for Labour and Defence of the R.S.F.S.R. to regard as matters of immediate practical importance the restoration of agriculture in the South East and the vigorous exploitation of the natural resources of this part of Russia.

The first essentials are, to ascertain the causes of the present trouble and to discover remedies. With this must go hand in hand the development of the rural economy of the area, the encouragement of its agriculture in a manner which shall be equally harmonious with the special needs of the locality and with the general economic interests of the Republic. We must elaborate a comprehensive plan of practical measures which will enable us to perform these tasks and to promote a far-reaching development of the productive forces of the South East. The State Economic Planning Commission does not underestimate the intricacy, the difficulty, and the responsible character of the problems awaiting solution. All the members of the Commission are aware that these problems have to

[1] See page 167, Russian Weights and Measures.

be formulated and solved in accordance with the interests of the Republic and of the hard-working peasant farmers.

The subjoined symposium, the work of eminent specialists, does not represent the entire scope of the proposed undertakings. But the urgent needs of the moment in conjunction with other practical considerations have necessitated the publication of the present brief sketch, pending the time when the Section for Rural Economy of the State Economic Planning Commission will have been able to elaborate a finished general plan for the restoration of the South East.

One of the items in the program of our studies has been to ascertain the extent of the disaster affecting the Mid-Volga and Lower-Volga regions, basing our conclusions upon precise statistical data. Another has been, to determine the physical and economic conditions of the area and to estimate its productive resources. A third has been, to decide upon the measures immediately essential for the assistance of the famine-stricken population, by the organisation of such works as are economically expedient—these undertakings to form links in a system of measures for the restoration of the peasant economy as a whole and for the protection of the working strength of the rural population. In addition, the symposium aims at emphasising the need for the rationalisation of husbandry in conjunction with agricultural reorganisation and the inauguration of land-improvement schemes; at the demonstration of concrete technical undertakings; at formulating precise calculations as to the need for rehabilitating the stock of agricultural implements and machinery, farm beasts, technical instruments and appliances, materials, etc. The basis of all these estimates has been the consideration of what will be requisite to restore the area of sown land to the proportions which obtained in the year 1916. Data are furnished concerning the possibility of promoting horticulture, concerning the industrial elaboration of the products of agriculture, concerning the development of the fishing industry, concerning the output of raw materials of animal origin, concerning the working of the shale deposits, concerning the development of home industry, etc.

None of the important problems of the Republic can be solved except in conformity and in harmony with the general scheme for the electrification of the R.S.F.S.R. This scheme is the starting-point of all the further economic development of the country. Upon the basis of concrete

calculations and of a consideration of measures that are practically realisable, the report formulates a minimum program for the electrification of the South East.

As far as possible, in connexion with the various schemes, estimates as to cost have been incorporated, worked out in gold roubles. This will give a clear idea of the scope and limits of the suggestions as to immediate work for the restoration of economic stability to the South East, with a view to the subsequent purposive encouragement of the energies of the area.

Pressure of time and the urgent need for having the subjoined report printed without delay, made it impossible to include a number of studies by experts relating to such subjects as road construction, stock-raising, various branches of large-scale industry, etc. These gaps will be filled by the subsequent publication of another important symposium which will be issued by the Section for Rural Economy of the State Economic Planning Commission.

S. P. SEREDA,

President of the Section for Rural Economy of the State Economic Planning Commission.

Moscow, September 10th, 1921.

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ever they are vital to the issue. This method of exposition will enable us to grasp the peculiarities of each province as regards soil and agricultural methods, and then to draw up a general balance-sheet for the agriculture of Russia as a whole and of the south-eastern area in particular.

Samara Province.

A considerable part of Samara province, together with the northern margins of south-eastern Russia, lies outside the area of typically dry soils and barren steppes. Only the southern margin of the province (formerly known as Nikolayevsk county, but now renamed Pugachevsk) belongs to the typical south-eastern region. The prevailing type of soil in Samara province is that known as black earth. The central clayey region of the black earth occupies a premier place, and in virtue of its physical and chemical qualities can be regarded as an extremely fertile soil. Even when drought prevails, there is usually quite a good harvest in most parts of the province. In this respect the northern and eastern counties are the most dependable. Here in patches we find the fertile soil of the northern parts of south-eastern Russia—the so-called typical black earth, the fat land noted for its strength and rich in fertilising elements.

Into the northern parts of Samara there intrude strips from the adjoining provinces, strips of the so-called dark-grey forest steppes and grey wooded clay lands. These require much less expenditure of manure, and less attention generally in the way of special agricultural measures, such as the systematic import of artificial manures, or the organisation of an elaborate system of rotation of crops.

In the western parts of the province, quite close to Samara county, we find for the most part sandy varieties of black earth—sandy black earth and black-earthy sand. Though they resemble the dominant type of clayey black earth in their qualities, these soils are distinctly inferior in respect of fertility.

In the southern part of the province, beginning with the county which used to be called Nikolayevsk and is now known as Pugachevsk, and especially in the basin of the Irgiz, we have already entered the region of the dry steppes. Here we find varieties of chestnut-brown clays and of the so-called chocolate (or southern) black earth. In this county we find saline earths of various grades. In reasonably moist seasons the sometime Nikolayevsk county yields a fairly good crop of cereals, including a certain amount of wheat.

We must note that although throughout a considerable

part of Samara province there prevails the black earth of the meadow steppes, nevertheless the influence of the south-eastern peculiarities of soil is plainly perceptible. We note a dazzling character of the surface; in places, a rapid loss of the friability of the soil; here and there a partial caking; and sometimes we note the appearance of an efflorescence of salt, showing that the soil is strongly saline. Thus, although Samara province is one of the most fertile and richest of the provinces, in its eastern and especially in its south-eastern portions we enter the precincts of the arid area, encountering the breath of the desert with all its consequences. As far as Samara province is concerned, in addition to general measures for the improvement of agriculture, the essential requisites would appear to be the introduction of plough cultivation and of a system of rotation of crops—meadow land alternating with a many-field system.

Orenburg. Province.

A considerable part of Orenburg province (in especial the Orenburg and Orsk counties) belongs to the region of perennial drought with all its consequences in the production of dry and desert steppes. In this respect, the province resembles the neighbouring provinces of Russia in Europe and Russia in Asia. Apart from the extreme dryness, the salient characteristics of the soil are the prevalence of chestnut-brown clays and sands, but we sometimes encounter light-brown clays and sands. The soil of this province is fairly fertile, but it needs careful handling, and the adoption of those measures which were indicated above as applicable to Samara. Salt deposits of various kinds are found in Orenburg, including table salt.

Saratov Province.

Saratov province exhibits numerous varieties of soil. In the northern part of Kuznetsk county, in the forest belt, we reach soils of the northern type, grass-covered and alkaline sands, quite different in respect of fertility from the soils typical in south-eastern Russia. For this reason Kuznetsk county must be excluded from consideration when we are concerned with the soils of the dry and desert steppes. Inasmuch, however, as this county belongs to south-eastern Russia in respect of its geographical situation no less than of its administration, it must be provisionally included, bearing in mind the characteristics of the province. In dry seasons this county is less exposed to vicissitudes in the harvest, partly, because the whole harvest of the region is scanty, and partly because the arable area is comparatively small. The region is inter-

mediate between the cultivated lands and the forest lands. For the proper exploitation of the soil of this county, the import of artificial manures is essential, in addition to the organisation of plough culture and of a rotation of crops.

In the northern and western parts of the province we find a whole series of counties belonging to the region of the different kinds of black earth. These form an almost continuous strip. Here are sandy black-earth soils and black-earth sandy soils, interspersed with dark-grey forest lands and grey wooded clays (Volsk, Khvalinsk, the northern part of Petrovsk); the clayey black earths of the Petrovsk, Serdobsk, Atkarsk, and Balashov counties. Balashov county contains strips of a stronger and more fertile black earth resembling the southern black earths.

In view of the character of the soil and in view of other physical characteristics, the whole of the before-mentioned region can be included in the typical South East. It has of late been so included by many investigators, on the ground of serious and fundamental considerations. Nature, however, makes no leaps. In nature, things shade into one another insensibly. Only, therefore, by the study of various phenomena, only by very careful examination of this strip of black-earthy soil bordered by areas where the soil is typical of arid zones, can we grasp the full significance of the peculiarities of the black earths of Saratov. Thus only are we enabled to differentiate the soil of this province from that of the adjoining western and southern provinces.

A great deal of what was said above regarding Samara applies also to Saratov. In addition we have to note the low fertility of the black earth in Saratov province. Or rather, we have to note that the yield of the soil here has become stabilised at a low level. The level is low because, although the soil contains a fair quantity of fertilising elements (about 6—10 per cent.), its friability disappears wholly or partly after a few years of persistent planting with cereals. Nevertheless the growing of such crops is essential if the advantageous physical qualities of the province are to be turned to good account.

The black-earth areas of Saratov province are subjected to the influences characteristic of regions where drought habitually prevails. We do not find in Saratov the regular harvests which are met with in the more typical black-earth regions. The questions which are of urgency in the typical regions of the South East are pressing also in Saratov province. I refer to the drought; to the need

for increasing fertility by restoring the friability of the soil; to the need for putting large areas under grass for many years in succession, and the need for plough culture with rotation of crops. Here and there salt begins to show itself in considerable quantities. For example, in Balashov county, among the typical black earths we find scattered areas of salt lands and salt marshes.

The remaining counties (Saratov, Kamishin, Novouzensk and the sometime Tsaritsin) may be almost entirely assigned to the typical region of the South East. Among the soils of these regions we encounter: in the black-earth region, weak black earths, black earths, pseudo-black earths, and southern black earths (Saratov county and part of Kamishin county); typical chestnut-brown soils of the dry steppes, together with various clays and sands (Novouzensk county); a whole series of salty varieties, light-brown and brown clays, and parti-coloured soils (Kamishin, Tsaritsin, and South Uzensk counties).

The whole of this area (especially Novouzensk county) yields a fairly good harvest in favourable years; but when the rainfall is low and a dry period sets in, the yield rapidly falls. Frequently, after two or three years of tillage, the local soils are allowed to lie fallow for several seasons in order to restore their fertility. In severe droughts, the whole of this belt, notwithstanding the richness of the local soils in nutritive materials, suffers terribly.

All these considerations show that, with good will, Saratov province might produce a more stable though not very considerable harvest, if better systems of agriculture were adopted. Nevertheless, the introduction of up-to-date methods of tillage, paying due account to the local peculiarities of the land and guided by the experience of the neighbouring black-earth regions, could not ensure that there should be really stable harvests even in seasons of average rainfall—to say nothing of the years of drought.

Among the measures essential for Saratov province, and in part for the dry belt, must be mentioned the introduction of plough culture, the organisation of a suitable rotation of crops with drought-resisting varieties of grain, and (no less essential) the systematic putting of land under grass.

Uralsk Region.

Uralsk region lies adjacent to Novouzensk county. Naturally, therefore, it shows itself to be a continuation of that county in respect of the physical conditions of the soil. To an even greater degree it exhibits the specific characters of the dry soils and the desert steppes.

The northern part of the region consists of chestnut-brown earth. For the most part it lies within the area of the Transvolgian watersheds. The remaining strip of this, practically all that lies southward of the line from Novouzensk to Uralsk, lies within the area of the desert steppe. Here we find many varieties of soil: light-brown clays; typical brown soils; innumerable transitions from slightly saline to more saline soils—saline earths, salt marshes, salt ooze, etc.

In the south of Uralsk region we find sandy soils of varying consistency and in various states of aggregation, ranging from strongly aggregated brown sands to shifting sandhills.

In this region there are numerous depressions and lagoons, together with a considerable number of streams without beginning or end, and chains of lakes with characteristic springtime floods. This is a suitable area for land-improvement schemes with the aid of various irrigation works. In view, however, of the local peculiarities of the soil, and more particularly in view of the widespread impregnation with salt, detailed study is requisite before such measures can be instituted on a large scale. As regards improvements in Uralsk region and Novouzensk county, we have as yet few data, but there are possibilities in the way of forming oases and of other improvements.

Generally speaking, down to the present time, the entire Uralsk region (if we except isolated cultivated oases) presents itself as typical desert steppe, refractory to cultivation. Parts of the south and the east of this region are continuous with the Transural desert areas of Turgai and other regions.

Turgai Region.

Turgai region may be characterised as an area of dry and partly desert steppe. Its soils are those appropriate to the steppes. We find chestnut-brown and brown earths with various transitional varieties ranging from weakly saline earth to different sorts of light-brown saline earths, salt marshes, salt ooze, intermittently flooded areas, etc. It is typical steppe, and in parts quite unsuitable for ploughing. Nevertheless, with an appropriate form of tillage it is fertile, and competent to yield a stable and at times a considerable harvest. In its productivity, much of the land in Turgai is nowise inferior to the black-earth region. For its fertility, however, Turgai will be dependent: first, upon a seasonable water supply, either the natural local rainfall which is not considerable, or upon irrigation; secondly, upon the organisation of rotation

of crops, of a many-field system alternating with putting the land under grass.

Such districts as Uralsk and Turgai regions are capable of producing enormous quantities of agricultural products under suitable conditions, when their agriculture has been organised in various ways and when farming has been universally systematised. For the successful exploitation of these regions, however, it is necessary that there should be a careful study of the local physical conditions. Further requisites are the introduction of skilled labour, the organisation of well-considered measures for wrestling with the salt lands, and the widespread adoption of scientific agricultural technique.

On the whole it may be said that these vast areas of dry and desert steppe, suitably exploited, offer extensive prospects to agriculture. In fact, they are regions with immense agricultural possibilities.

Astrakhan Province.

The vast expanses of Astrakhan province (using the term for the whole administrative area formerly included under that name) are typical dry steppe. The southern regions are desert steppe. Astrakhan is almost entirely devoid of vegetation throughout. The predominant soils are brown earths and various and many-coloured earths more or less impregnated with salt (the extant Astrakhan province, Buk-Arda, Tsaritsin province).

In the south and east of the province we find huge areas of salt marsh, swampy lagoons, and numerous lakes. Adjacent to the Caspian Sea are loose sandhills and dunes. Towards the west, in the Calmuck borderland, the soil contains a considerably larger amount of fertilising elements. Here we find chestnut-brown earth and black earth.

The area of the province lying along the Volga consists of an unending chain of lagoons, a belt of land liable to inundation. Here are the parallel channels of the Volga and the Akhtuba. Much of the land is waterlogged in the region of the Volga delta. Throughout the whole area we find the darkish and at times excessively damp soil of the Volga alluvium, in places considerably impregnated with salt.

The foregoing description, however, does not suffice to convey an adequate idea of the agricultural possibilities in this province. After an extensive survey of the province as a whole and of certain counties in particular, we gain a very different impression. In the spring and the autumn the whole of this apparently desert steppe

comes to life. In normal conditions it is covered at these seasons with a carpet of ripe vegetation. Through this rapid development followed by a swift dying down of verdure in the beginning of summer, the province naturally seems, in the height of summer, to be a desert. But throughout this area, in the summer taken as a whole, there live and flourish large quantities of perennial vegetations well adapted for agricultural purposes. However, they fade to yellow and grey tints, and on the various soils (yellow, yellow-grey, and tawny-brown clays and sands) there results a general aspect of monotony in colour.

On the low-lying lands (in the ravines and adjoining the lagoons) herbage grows almost throughout the summer. Among these areas (especially in the sometime Tsarevsk county) we find a number of belts suitable for plough culture, and here in normal years considerable crops are raised. The general defects of such soils are as follows: they are poorly supplied with fertilising elements; their consistency makes them unsuitable for cultivation; almost everywhere they contain compacted strata; they are overloaded with mineral substances and are lacking in humidity.

The belt lying along the Volga is a flowery oasis at its margin. Here, together with cereals and hay, a considerable space is, even under present conditions, allotted to melon growing, to gardens and vegetable gardens. The growth of all these crops is quite satisfactory and stable, for the local soils are fertile, and with a skilful rotation of the crops they yield good and often quite dependable harvests. We must devote serious attention to all this region of the Volga alluvium, to the chains of lagoons, and to the Volga delta, and we must adopt measures for the improvement of the agriculture of the district—measures of an original character, but comparatively inexpensive. Such improvements will give an impetus to the whole area. They will undoubtedly stimulate agriculture, enabling larger crops to be produced.

Speaking generally, Astrakhan province merits serious and many-sided attention. The physical conditions of the region and the characteristics of its soils are such that (notwithstanding the peculiarities of these soils and in especial their high impregnation with salt) we can confidently anticipate great improvements in this extensive area, where very diversified conditions prevail. If the matter be taken in hand on the proper lines, the results are likely to be of considerable value to Russian agriculture

as a whole. Nor must we forget—to pass beyond agriculture for a moment—that the fisheries of Astrakhan are of great importance.

Stavropol province lies outside the typical region of the arid South East. It has the aspect of a continuation of this region to the south, for it resembles the above-described provinces in its physical and geographical conditions, and has much in common with them. However, the influence of the neighbouring Caucasus already begins to make itself felt, especially in the character of the soil. Stavropol Province.

In this respect, the province may be briefly characterised as a steppe region with southern black earths, chestnut-brown clays, and clayey black earths. There are numerous transitional grades between these varieties, but the general qualities of the soils are those of steppe black earths and chestnut-brown clays.

The land is fairly fertile, and yields a good harvest in years of average rain-fall. Nevertheless, in default of suitable measures for the improvement of agriculture in the drier regions, this province must be included within the area where the harvest is unreliable, within the area exposed to the influences of a dry climate.

We need not pause to give so detailed an account of the physical characteristics and the soils of the northern provinces suffering from failure of the crops in the year 1921. It will suffice to give a brief account of the soils of the following provinces: Vyatka, Kazan, Simbirsk, and Ufa. The Soils of the northern Provinces suffering from Failure of the Crops in 1921.

In Vyatka the soils are of the northern type. Here we often find grass-covered and alkaline clays superposed upon lighter sandy clays. To a lesser extent, we find here and there grass-covered and alkaline sands and sandy soils. In places we encounter dark-grey forest steppes and grey wooded clays. Vyatka Province.

The before-mentioned soils need, as a rule, the introduction of artificial manures, the use of farm-yard manure, sowing with fine hay-seed, and other measures for the proper organisation of agriculture. The local soils exhibit a fair average fertility.

The soil of Kazan province is somewhat diversified. Occupying an intermediate position between the northern areas on the one hand and the southern and south-eastern areas on the other, Kazan naturally gives the impression of the physical and geographical qualities of both these areas. The fertility and the productivity of the land in Kazan Province.

this province depend upon the latitude, upon climatic conditions, and upon other peculiarities of the countryside.

We find the following soils: dark-grey forest steppes and grey wooded clays; clayey black earths; sandy black earths and black-earthy sands; here and there, stronger black earths. Along the rivers there is an abundance of water meadows and meadow land, where excellent hay crops are grown.

Simbirsk Province.

In Simbirsk province we find a considerable variety of soils, including those characteristic both of the northern and the southern steppes. Part of the province is occupied by various soils of a sandy type. We find grass-covered and alkaline sands, a number of sandy soils, sandy black earth and black-earthy sand; here and there, a more compacted clayey black earth is met with, and occasionally the so-called fat and strong black earth. Along the rivers, a more notable quantity of water-meadow land prevails. The diversified character of the soils, both in aspect and in structure, definitely indicates that their fertility cannot depend upon any one series of causes. We find in Simbirsk extensive variations in quality and structure not due to the occurrence of drought.

Ufa Province.

It is needless to describe Ufa province in detail, for the region is fairly fertile. Suffice it to say that to a considerable extent Ufa can be assigned to the steppe region, with the exception of the counties adjoining the Urals. Speaking generally, there prevails throughout the province a tolerably fertile soil having steppe characteristics, but in certain localities steppe is replaced by wooded areas.

The following soils are found: an average clayey black earth; in places a stronger and fatter black earth; dark-grey forest-steppe clays and grey wooded clays; sandy black earths, and grass-covered and alkaline sands; here and there, gravels and coarser varieties of soil of the before-mentioned kinds; alluvial soils in the meadow lands and riverine areas.

THE AGRICULTURAL CHARACTERISTICS OF THE SOUTH EAST AND THE EXTENT OF THE FAILURE OF THE CROPS

J. V. BLYAHER

Introduction.

WE have to examine the economic and agricultural characteristics of the area affected during the current year with a complete failure of the crops. It embraces the following provinces and regions: Tartar Republic, the Marii and the Chuvash regions, Simbirsk province, Vyatka province together with the Votyak region, and the provinces of Ufa, Samara, Saratov, Marxstadt, Tsaritsin, Astrakhan, and Uralsk. The areas enumerated do not comprise the entire district suffering from failure of the crops, for we must also include therein some of the provinces of the Kirghiz Republic, certain counties of Stavropol province, Penza province, Don Cossacks province, etc. We limit ourselves to the consideration of the area thus specified because here the failure of the crops has been most intense and has prevailed throughout the whole countryside. We thus exclude from consideration detached counties that have suffered from the drought.

The aforesaid area can be divided into two more or less sharply distinguished sub-areas, respectively exhibiting fairly uniform characteristics. In one of these we may include the Tartar Republic, the Marii and the Chuvash regions, Simbirsk province, Vyatka province together with the Votyak region, and Ufa province; this may be provisionally named the Mid-Volga sub-area. In the second we may include the provinces of Samara, Saratov, Marxstadt, Tsaritsin, Astrakhan, and Uralsk; this may be provisionally named the Lower-Volga sub-area. It is true that if we were to abide by the old delimitations of the above-mentioned provinces, we should have to divide the areas in a rather different manner. For example, Vyatka province would have to be excluded from the Mid-Volga sub-area and transferred to the Ural area if we wished to avoid violating the established grouping of provinces. However, most of the provinces with which

we are concerned have had their boundaries modified to such an extent that the old groupings are no longer accordant with present needs. Provisionally, therefore, we may group them in the before-mentioned sub-areas.

General Characteristics.

Before discussing the characteristics of the respective sub-areas, we may point out that the territory suffering from failure of the crops embraces about 56,430,000 desyatinas (not counting Uralsk region, as to which data are lacking). The rural population is 16,180,000, and the urban population is 2,080,000, making a total population of 18,260,000. According to the reports for the year 1920, this constitutes 16 per cent., or approximately one-seventh, of the population of the Russian Socialist Federal Soviet Republic together with Ukraine.

The chief occupation of the inhabitants of this area is the tilling of the soil. Barely 4 per cent. of the rural population is engaged in non-agricultural work.

That we may better understand the significance of the area now under consideration in relation to the economic life of the country in general and to its agricultural production in particular, it may be pointed out that, according to agricultural data of the year 1916, the rural population of this area amounted to 20 per cent. or one-fifth part of the entire rural population of what was known as European Russia at that date. Its cultivated area comprised 24 per cent. or very nearly one-fourth of the whole cultivated area of European Russia. Its taxable strength was computed upon the basis that it contained 23 per cent. of the draught horses and 17 per cent. of the oxen in what was then known as European Russia.

The annual export of grain from this area (excess of exports over imports), according to the transport statistics for the period 1909–1913, attained the notable amount of 187,821,000 poods, comprising 24 per cent. of the total export of the then Russian empire, and 55 per cent. of the export of the productive provinces of European Russia (not counting Ukraine and northern Caucasia). Turning, now, to Saratov, Samara, Ufa, and Simbirsk provinces, which also have been exporting areas, the data show that out of a total export of 188,000,000 poods, about 35 per cent. was destined for the foreign market. This means that every year there was sent abroad from the provinces just enumerated a quantity of grain amounting approximately to 65,000,000 poods.

The foregoing figures suffice to show that the agriculture of this area played an extremely important part in the

agricultural production of Russia in general, and consequently in the whole economic life of the country. But the imperialist war and subsequently the civil war, together with the failure of the crops during the past year, brought about a terrible disturbance of the economic life of this area, and in particular of its main prop, agriculture. Thus, in the year 1916 the average amount of land under cultivation per hundred of the rural population was 92 desyatinas. In 1921, although in the interim the landlords' estates had been transferred to the peasants, the area under cultivation per hundred of the rural population had fallen to 58 desyatinas, this being a reduction of 37 per cent. The number of draught horses and oxen fell from 26 in 1916 to 14 in 1921, a reduction of 46 per cent. The number of cows fell from 23 to 16, a reduction of 30 per cent.

This decrease in the scale of production may legitimately be termed catastrophic. Accompanied as it is by a quantitative decline in the instruments of production showing itself in the form of a falling off in the number of horses and likewise of cows (this implying the deterioration of peasant agriculture), it cannot but arouse alarm as to the future of the aforesaid area, which is one of the granaries of the Republic.

Let us now turn to consider the characteristics of the respective sub-areas. The figures in the following table give a picture of the contemporary state of affairs.

Characteristics of the two Sub-areas.

A Comparison of the fundamental Elements of Agriculture.[1]

Sub-Area.	Per 100 of Rural Population.					Per 100 Desyatinas Sown.					Per 100 Desyatinas of Ploughed Lands that are actually Sown.
	Desyatinas of ploughed Land.	Desyatinas of sown Land.	Large Farm Beasts.	Among which are: Draught Horses and Oxen.	Among which are: Cows.	Draught Horses.	Oxen.	Swing-Ploughs and Hook-Ploughs.	Wheel-Ploughs.	Reaping Machines.	
Mid-Volga	138	62	34	12	16	19	0·01	12	9	1·1	45
Lower-Volga	173	52	42	16	17	26	4	6·9	11	2	30

[1] The figures in the table are based upon data obtained from the Central Statistical Board for special investigation in the summer of

A Comparison of the fundamental Elements of Agriculture—continued.

Per 100 Desyatinas Sown.

Sub-Area.	Rye.	Wheat.	Barley.	Oats.	Buckwheat.	Millet.	Other Cereals.	Potatoes.	Oleaginous Plants.				Sown Grass.	Other Plants.
									Flax.	Hemp.	Sunflower.	Others.		
Mid-Volga	52·5	3·9	1·2	27·6	3·5	5·5	2·8	1·4	1·3	0·2	0	0	0·1	0
Lower-Volga	41·9	29·7	2·7	5	0·3	14·4	1	0·8	0·4	0·2	2·7	0·1	0	0·8

The Extent of Agricultural Activity and the Diminution of the sown Areas.

The first thing to attract our attention in the foregoing tables is the notable difference in the extent of agricultural activity in the respective areas. In the Mid-Volga sub-area there are 138 desyatinas of ploughed land per 100 of the rural population, whereas in the Lower-Volga sub-area there are 173 desyatinas, or 25 per cent. more. Manifestly, the vast steppes of Lower-Volga give more scope than the higher reaches of the river for the free development of agriculture.

Turning, however, to the comparative sowings, we find that, in 1921, per 100 of rural population, in Mid-Volga 62 desyatinas were sown, but in Lower-Volga only 52 desyatinas. In other words, notwithstanding that there are far greater ploughing possibilities in Lower-Volga, the actual amount of land sown here in 1921 was considerably less than in Mid-Volga. This is not because of the system of extensive agriculture which predominates in Lower-Volga, but mainly because (for the reasons previously specified) during the last year the sown area has been reduced to an enormously greater extent in Lower-Volga than in the higher parts of the Volga basin. In fact, whereas the sown area per hundred of the population fell from 84 desyatinas in 1916 to 62 desyatinas in 1921 (a reduction of 26 per cent.), during the same period in

1921. The plan according to which the investigations were carried out was to take in each rural district a record of the work of thirty farms. For each district, parallel reports were drawn up, showing the conditions in 1920 and 1921 respectively. In this way materials were accumulated permitting a determination of the coefficient of the changes which took place during the period 1920–1921: (1) in the amount of land under cultivation and in the sowing of various crops; (2) in the number of different sorts of farm beasts. By means of this coefficient, with the assistance of the data in the consecutive All-Russian Agricultural Reports for 1920, it was possible to calculate the absolute magnitudes of the various items for the year 1921.

Lower-Volga the reduction was from 104 desyatinas to 52 desyatinas (nearly twice as great). It is obvious that in Lower-Volga the civil war, and to an even greater extent the failure of the crops of the last year, have played an extremely disastrous part. The disproportionateness in the reduction of the sown area in the respective regions amounted to this, that whereas in Mid-Volga out of 100 desyatinas of ploughed land 45 were sown in 1921, in Lower-Volga in the same year only 30 desyatinas were sown. In Mid-Volga under normal conditions the three-field system prevails, so that there the sown area was not less than 65 per cent. of all the ploughed lands. In Lower-Volga, however, side-by-side with the three-field system there is a system of leaving areas entirely untilled, so that here in normal times the sown area usually fell to 50 per cent. of the ploughed lands but not lower.

Draught Beasts and Farming Implements.

Owing to this curtailment of the sown area, we find both in Mid-Volga and in Lower-Volga, but especially in the latter, a ratio between the quantity of farm beasts and of farming implements, on the one hand, and of sown areas, on the other, which exceeds the maximum requirements of agricultural technique. In fact, in Mid-Volga, per 100 desyatinas of sown land in 1921 there were 19 cart-horses, this being about 5 desyatinas per horse. One horse normally suffices for the work of 6 desyatinas. As far as ploughs were concerned, in the same district there were per 100 desyatinas 12 swing-ploughs and hook-ploughs and 9 wheel-ploughs; likewise, that is to say about 5 desyatinas per plough. Normally we reckon 10 to 12 desyatinas per plough. In Lower-Volga the facts are even more remarkable. Here there are 26 cart-horses and 4 oxen for every 100 desyatinas of sown land, this being less than 4 desyatinas per head of draught beasts. Per 100 desyatinas of sown land there are 7 swing-ploughs and hook-ploughs and 11 wheel-ploughs. It may, of course, be contended that the swing-ploughs and hook-ploughs which survive in the countryside are merely venerable antiques, and that nowadays ploughing is exclusively done with wheel-ploughs. If this be so, the stock of ploughs closely corresponds to the demands of the now diminished sown areas. It is, however, an obvious deduction from the foregoing argument that the restoration of the sown area to its pre-war dimensions is inconceivable without an increase in the number of ploughs—all the more inasmuch as a considerable proportion of the wheel-ploughs is only fit for the scrap-heap. Despite

what we have said above concerning the excess in the quantity of draught beasts on the farms when the land is sown only to the present amount (so that the cart-horses are eating their heads off even more than ever before), it is obvious in view of the necessary ratio between the number of draught beasts and the area of sown land, that the sown area cannot be restored to the dimensions of the year 1916 unless there is an increase in the number of cart-horses. But owing to the failure of the crops and the scarcity of fodder there is a danger that the number of cart-horses in the area under consideration will be considerably reduced in the near future.

As regards harvesting machines, the number of these has always been so small that even for the diminishing area of land sown we must admit the quantity to be utterly insufficient. In Mid-Volga, per 100 desyatinas sown there are 1·1 reaping machines; in Lower-Volga, for the same area, there are 2. Manifestly the dearth of these machines (to say nothing of the fact that they are wearing out) will become yet more obvious when the pre-war extent of sowings is resumed.

The resumption of sowings on a pre-war scale is a *conditio sine qua non* of the re-establishment of more or less normal agricultural conditions throughout the whole of this territory. It is essential to the increase of production, which will itself serve as the starting point of a vigorous industrial development.

Relative Proportions of sown Crops.

With what crops was this greatly reduced area planted in the course of the year 1921? What changes, if any, in this respect had there been since 1916, the year in which the conditions were nearest to those of the pre-war period?

The answer is given by the following figures:—

Per 100 *Desyatinas Sown.*

Sub-Area.	Year.	Rye.	Wheat.	Barley.	Oats.	Buckwheat.	Millet.	Potatoes.	Flax.	Sunflower and Mustard.	Sown Grass.	Other Plants.
Mid-Volga	1916	45	8	3	28	4	3	2	2	0	0·3	4·7
	1921	52·2	3·9	1·2	27·6	3·5	5·5	1·4	1·3	0	0·1	3
Lower-Volga	1916	28	48·1	3	8	1	5	1	0·2	2·5	1	2·2
	1921	41·9	29·7	2·7	5	0·3	14·4	0·8	0·4	2·8	0	2

Both the sub-areas are characterised by an extremely monotonous system of crops. This cannot fail to lead to an increasingly poor yield, inasmuch as year after year the same chemical substances are withdrawn from the ground, and thereby the soil is utterly impoverished. The foregoing data show that in the period 1916–1921 a few changes occurred in the relative proportions of the various crops sown; but the poverty of the sowings, their oppressive monotony, remained quite unaffected. As it was in 1916, so was it in 1921. Mid-Volga may be spoken of as the rye-oats sub-area, seeing that 73 to 79 per cent. of the sown fields are occupied by these two crops. In 1916, Lower-Volga might have been termed the rye-wheat sub-area, and in 1921 the wheat-rye sub-area, seeing that from 72 to 76 per cent. of the sown land was under these two crops. In both of the sub-areas, out of all the other crops, not one occupied any considerable space; they ranged to 3 or 4 per cent. of the sown land, and in one or two cases to 10 per cent. or more.

The before-mentioned changes in the proportions of the various crops sown in the period 1916–1921 were comparatively more extensive in Mid-Volga and comparatively less extensive in Lower-Volga. They amounted to this. In Mid-Volga the sowings of rye increased from 45 per cent. to 52·2 per cent. and those of millet from 3 per cent. to 5·5 per cent. These increases ensued upon the diminution, principally in the sowings of wheat, and partly in the sowings of barley and potatoes. In Lower-Volga, the sowings of rye were likewise increased, but in a much greater proportion, namely, from 28 to 41·9 per cent. In like manner there was a greatly increased sowing of millet, from 5 per cent. to 14·4 per cent. At the same time, the area under wheat was reduced from 48·1 per cent. to 29·7 per cent., and the area under oats from 8 per cent. to 5 per cent.

There were two factors of these changes. First of all, there was a reduction in the general size of the sown areas, and this reduction depended primarily upon a diminished sowing of wheat, which in pre-war days was grown chiefly for export. With the discontinuance of foreign trade, there vanished the stimulus to the production of cereals for export. A contributory cause was the equal distribution of bread among the population, a system that remained in force down to the present year. This likewise suppressed all stimulus to the production of grain for the market. Consequently the peasants began to

restrict their agricultural operations to the growing of the corn requisite for the satisfaction of their immediate personal needs. This resulted in the sowing of more rye and less wheat. The second factor was that the peasants, partly in order to increase their own food supply and partly because of the years of drought, began to increase the sowings of millet, which is a drought-resisting crop.

The total Amount of the Grain Harvest and the Extent of the Suffering resulting from the Failure of the Crops.

What quantities of grain were harvested, and what is the extent of the suffering in the area with which we are concerned ?

We have at our disposal two kinds of statistical data issued by the Central Statistical Board. The data of the first kind relate to the period when, upon the foundation of harvest prospects, that is to say, before the population was seized with panic, estimates of the impending harvest were drawn up without any deductions such as obviously became necessary when there was a likelihood of the complete ruin of the crops in various parts of this or that county. The data of the second kind relate to the period when, upon the basis of new calculations, there seemed to be a possibility that the failure of the crops might prove less complete than had previously been feared. The difference between the first set of data and the second is clearly shown by the following figures. According to the first estimate it was believed that the grain harvest would amount in Mid-Volga to 118,039,000 poods, and in Lower-Volga to 61,913,000 poods; according to the second estimate, the figures were 69,075,000 and 33,725,000 respectively. Even if we take the more optimistic estimate as a basis for our calculations, we must obviously admit that there will not be enough corn to provision this granary of Russia until next year's harvest. There is a deficit of many millions of poods. If from the total harvest we deduct the amount necessary for seed corn, and calculate the quantity of grain required to provision the inhabitants (using a very low estimate of individual requirements, namely, ten poods per head—an allowance very near to famine), we find that the victualling requirements until next year's harvest work out to the following figures :

Sub-Area.	According to first Estimate of gross Corn Harvest.	According to second Estimate of gross Corn Harvest.
	Poods.	Poods.
Mid-Volga – – –	23,049,000	72,013,000
Lower Volga – –	23,206,000	51,394,000

It is true that to compensate the above-mentioned deficit there are still potatoes, to the amount of 18,991,000 poods in Mid-Volga, and 9,782,000 poods in Lower-Volga. These quantities are, however, inadequate. If we reckon that, as far as food values are concerned, four poods of potatoes are equivalent to one pood of corn, we see that the supply of potatoes would not suffice, to any notable extent, to make up the deficit.

The extent of suffering involved for this part of Russia stands out even more clearly if we ascertain the net harvest of the current year per head of population. Here are the figures in poods:

Sub-Area.	More favourable Estimate.	Less favourable Estimate.	Potatoes.
Mid Volga .	7·6	2·3	2·6
Lower Volga .	6·4	2·2	1·6

In view of the extreme difficulty of estimating the grain harvest of the current year with real precision, the Central Statistical Board, making the best of the available statistical material, was compelled to issue its calculations in the form of two variants. But in view of the practical needs of the situation, in order to ascertain the precise quantity of grain which it would be essential to import into the locality suffering from failure of the crops (if the population were to be fed until the garnering of next year's harvest), it was necessary that an attempt should be made to draw up one single estimate of this year's harvest. For this purpose a great deal of special work was undertaken in the way of collating statistical information. These investigations have shown that the data of the second group—data of a pessimistic character—must be regarded as approximately 40 per cent. too low.

When the due corrections have been made in the foregoing estimates, and when a final result has been worked out as regards the net corn harvest per head of population, the following figures are secured: Mid-Volga 5·3 poods; Lower-Volga 4·3 poods. In other words, the total deficit of cereals in the former district is 43,557,000 poods, and in the latter district is 37,912,000 poods.

Vegetables and grain harvested in the vegetable gardens Vegetables.

can to some extent make good the failure of the crops, but it is self-evident that the supplies from this source will not go far towards compensating the immense deficit in the food supply shown by the above calculations.

According to the reports of 1920, the total area covered by vegetable garden amounted to 107,400 desyatinas in Mid-Volga, and 102,900 desyatinas in Lower-Volga. As regards the proportions of the various crops sown in the vegetable gardens, no great difference is observable between the two sub-areas. In both, the main crop consists of potatoes, occupying 49 to 52 per cent. of the land; next comes hemp (21 to 26 per cent.). None of the other crops occupies a notable proportion of the remaining land. We may mention: cabbages, 4·5 to 4·8 per cent.; cucumbers, 2·2 to 3·6 per cent.; and onions, 0·8 to 1·5 per cent.

The general production of vegetables, estimated in terms of cereals, amounts to a total of 9,175,000 poods in Mid-Volga, and 10,697,000 poods in Lower-Volga; per head of population this is from 0·7 to 0·9 of a pood.

Grass Lands and the Supply of Farm Beasts with Fodder.

In Mid-Volga there are 1,129,000 desyatinas of good hay lands, and in Lower-Volga there are 2,373,000 desyatinas. This amounts in each sub-area to 7 to 8 per cent. of all the good land. Out of the aforesaid grass lands, in Mid-Volga 43 per cent. consists of water meadows, and 57 per cent. of ordinary grass fields. The corresponding proportions in Lower-Volga are 35 per cent. and 65 per cent.

The total hay crop for the present year can be reckoned at 61,240,000 poods for Mid-Volga, and 92,985,000 poods for Lower-Volga.

The amount of straw available can be determined upon the basis of calculations concerning the normal ratio as between the weight of grain and straw. Consequently, from the two variants of the grain total, two variants of the straw total can also be worked out. According to the above data concerning the grain harvest, the straw total works out, in the case of the higher estimate, at 153,451,000 poods for Mid-Volga, and at 86,684,000 poods for Lower-Volga; in the case of the lower estimate, the corresponding figures are, 89,797,000 and 47,217,000, respectively.

Summing up the total of hay and the total of straw estimated in terms of hay, we secure a grand total of fodder which, per head of the larger farm beasts, amounts according to the foregoing harvest estimates in Mid-Volga to 49 poods (or 37 poods); in Lower-Volga the corre-

sponding figures are 51 poods (or 42 poods) per head of large farm beasts.

If we adopt the before-mentioned correction, in accordance with which the lower harvest estimates were to be increased by 40 per cent., the supply of fodder per head of farm beasts would work out at 44·2 poods for Mid-Volga and 46·4 poods for Lower-Volga.

If we assume the period of stall feeding to last six months, and if we suppose that for the remaining half of the year the beasts can live exclusively by grazing, the fodder available per month per head is only 7 to 7·5 poods. This works out at approximately 9 lbs. per day, which is, of course, practically a starvation allowance.

If we lump the victualling resources—the cereals, potatoes, and vegetables—we find that they work out per head at 8·8 poods for Mid-Volga and 7·2 poods for Lower-Volga. This is even less than a hunger ration. We must bear in mind that we have been dealing with average quantities. Actually, the quantities vary widely from place to place, so that in certain provinces, and *à fortiori* in certain counties and rural districts, the available resources must be considerably lower.

All the foregoing considerations lead us to the conclusion that, in the above-named sub-areas, and especially in Lower-Volga, the population will suffer terribly from the dearth of food and fodder, and that in certain provinces there will be positive starvation. In the struggle with famine, the population will necessarily have recourse to substitutes. In part they will compensate for the lack of bread by eating meat. This will lead to a still farther reduction in the number of the farm beasts, all the more seeing that these, as we have just learned, are already in large part doomed to destruction owing to the insufficiency of fodder.

TABLE I.—*Population, Area of Cultivation, and total Harvests (according to the Data of the special Investigation in the Year 1921).*

Sub-Area.	Population.			Desyatinas of ploughed Land.	Desyatinas of sown Land.	Desyatinas Sown.			
	Rural.	Urban.	Totals.			Rye (Winter).	Wheat (Summer).	Barley.	Oats.
Mid-Volga[1]	9,370,000	927,000	10,297,000	12,965,100	5,785,900	3,036,200	224,700	71,700	1,594,600
Lower-Volga[2]	6,810,000	1,153,000	7,963,000	11,800,600	3,543,100	15,181,300	991,100	52,300	198,200
Totals	16,180,000	2,080,000	18,260,000	24,765,700	9,329,000	18,217,500	1,215,800	124,000	1,792,800

Sub-Area.	Buck-wheat.	Millet.	Spelt.	Beans.	Melons, Pumpkins, Leeks, etc.	Vegetables and Fruit.	Lentils.	Maize.	Potatoes.	Flax.	Hemp.	Sun-flowers.	Mustard
Mid-Volga	201,300	319,800	85,700	63,100	—	—	16,000	—	78,500	74,100	12,600	200	—
Lower-Volga	11,200	519,100	3,700	6,600	25,100	5,300	28,800	1,800	29,200	16,100	8,800	110,900	1,600
Totals	212,500	838,900	89,400	69,700	25,100	5,300	44,800	1,800	107,700	90,200	21,400	111,100	1,600

Sub-Area.	Camelina, and other oleaginous Plants.	Tobacco.	Various.	Sugar-Beet.	Annual and perennial Grasses.	Gross Harvest in poods.[3]		Requirements of Seed.	Requirements for rural Population.
						Maximum Estimate.	Minimum Estimate.		
Mid-Volga	100	—	1,600	—	5,700	118,039,000	69,075,400	46,929,100	93,335,000
Lower-Volga	3,400	200	900	300	—	61,912,600	33,724,900	18,224,100	66,895,000
Totals	3,500	200	2,500	300	5,700	179,951,600	102,800,300	65,153,200	160,230,000

Sub-Area.	Surplus and Deficit.		Gross Potato Crop estimated in Terms of Grain.	Net Potato Crop.	Net Crop per Head.		
	Maximum Estimate.	Minimum Estimate.			Grain.		Potatoes.
					Maximum Estimate.	Minimum Estimate.	
Mid-Volga	23,049,000	71,188,700	24,352,700	18,991,200	7·6	2·3	2·6
Lower-Volga	43,206,500	51,394,200	13,011,600	9,782,100	6·4	2·2	1·6
Totals	66,255,500	122,582,900	37,364,300	28,773,300	14	4·5	4·2

[1] Mid-Volga sub-area comprises: the Tartar Republic, the Marii and the Chuvash regions, Simbirsk province, Vyatka province together with the Votyak region, and Ufa province.

[2] Lower-Volga comprises the provinces of Samara, Saratov, Marxstadt, Tsaritsin, Astrakhan, and Uralsk.

[3] According to the data of the current agricultural statistics, which are based partly upon the reports of the local governmental organs and partly upon information furnished by private correspondents.

Sub-Area.	Horses.				Large horned Cattle.					
	Four Years and upwards.	One-, Two-, and Three-Year-Olds.	Foals up to One Year.	Totals.	Oxen.	Bulls over Two Years.	Cows.	Heifers over 1½ Years; Bulls from 1½ to 2 Years; Heifers and Bulls from 1 Year to 1½ Years.	Calves under One Year.	Totals.
Mid-Volga .	1,110,000	159,000	135,000	1,404,000	500	7,500	1,468,000	221,000	426,000	2,123,000
Lower-Volga .	934,000	181,000	123,000	1,238,000	135,500	19,600	1,147,000	145,000	430,000	1,877,100
Totals .	2,044,000	340,000	258,000	2,642,000	136,000	27,100	2,615,000	366,000	856,000	4,000,100

Sub-Area.	Sheep.			Goats.			Swine.				Camels.	Totals of Farm Beasts.
	Ewes, Wethers, and Rams.	Lambs.	Totals.	She-Goats, and He-Goats.	Kids.	Totals.	Sows and Porkers over one Year old.	Piglings from 4 Months to one Year old.	Sucking Pigs.	Totals.		
Mid-Volga .	2,098,000	914,000	3,012,000	51,000	28,000	79,000	193,000	134,000	209,000	536,000	—	7,154,000
Lower-Volga .	2,259,000	780,000	3,039,000	109,000	34,000	143,000	34,000	76,000	50,000	160,000	78,000	6,535,100
Totals .	4,357,000	1,694,000	6,051,000	160,000	62,000	222,000	227,000	210,000	259,000	696,000	78,000	13,689,100

TABLE III.—*Areas under Hay, and Crop of Hay and Straw.*

Sub-Area.	Desyatinas of Hay Lands.	Gross Harvest of Hay in Poods.[1]	Gross Straw Crop in Poods.		Totals of Hay, and of Straw used as Fodder, in Poods.		Number of Poods of Fodder available per Head of large Farm Beasts.	
			Maximum Estimate.	Minimum Estimate.	Maximum Estimate.	Minimum Estimate.	Maximum Estimate.	Minimum Estimate.
Mid-Volga .	1,929,000	61,240,000	153,451,000	89,797,000	160,983,000	119,610,000	49,000	37,000
Lower-Volga .	2,278,000	92,985,000	86,684,000	47,217,000	146,792,000	121,138,000	51,000	42,000
Totals .	4,207,000	154,225,000	240,135,000	137,014,000	307,775,000	240,748,000	100,000	79,000

[1] According to the data of the current agricultural statistics which are based partly upon the reports of the local government organs and partly upon information furnished by private correspondents.

TABLE IV.—*Number of Farming Implements (according to the Data of the special Investigation in the Year 1921).*

Sub-Area.	Mole-Ploughs.	Grubbers.	Swing-Ploughs, Hook-Ploughs, and Two-Wheeled Ploughs.	Wheel-Ploughs (one-shared, two-shared, and many-shared).	Iron Harrows.	Harrows (with wooden Teeth, with wooden Frames, with iron Teeth).	Scarifiers.	Rollers.
Mid-Volga .	269	679	716,305	522,372	68,737	1,063,693	2,129	15,737
Lower-Volga .	836	1,204	242,577	381,710	54,488	587,995	1,115	22,245
Totals .	1,105	1,883	958,882	904,082	123,225	1,651,688	3,244	37,982

Sub-Area.	Sowing Machines of various kinds.	Reaping Machines (Cutters and Binders).	Other Harvesting Machines.	Threshing Machines.				
				Hand-driven.	Horse-driven.	Steam-driven.	Motor-driven.	Threshing Stones.
Mid-Volga .	20,011	62,278	11,480	18,827	22,634	438	1,122	19,936
Lower-Volga .	33,851	70,257	24,135	14,814	12,708	566	680	48,890
Totals .	53,862	132,535	35,615	33,641	35,342	1,004	1,802	68,826

Sub-Area.	Winnowing Machines.	Chaff and Hay Cutters, etc.	Scythes.	Sickles.	Miscellaneous.
Mid-Volga .	84,887	851	1,305,086	3,078,934	279,314
Lower-Volga .	85,682	849	457,120	831,006	49,182
Totals .	170,569	1,700	1,762,206	3,909,940	328,496

TABLE V.—*Comparison of the fundamental Elements of Agriculture (according to the Data of the special Investigation in the Year 1921).*

Sub-Area.	Per 100 of Rural Population.					Per 100 Desyatinas Sown.					Per 100 Desyatinas of Ploughed Lands that are actually Sown.
	Desyatinas of ploughed Land.	Desyatinas of sown Land.	Large Farm Beasts.	Among which are		Draught Horses.	Oxen.	Swing-Ploughs and Hook-Ploughs.	Wheel-Ploughs.	Reaping-Machines.	
				Draught Horses and Oxen.	Cows.						
Mid-Volga	138	62	34	12	16	19	0·01	12	9	1·1	45
Lower-Volga	173	52	42	16	17	26	4	6·9	11	2	30

Per 100 Desyatinas Sown.

Sub-Area.	Rye.	Wheat.	Barley.	Oats.	Buckwheat.	Millet.	Other Cereals.	Potatoes.	Oleaginous Plants.				Sown Grass.	Other Plants.
									Flax.	Hemp.	Sunflower.	Others.		
Mid-Volga	52·5	3·9	1·2	27·6	3·5	5·5	2·8	1·4	1·3	0·2	0	0	0·1	0
Lower-Volga	41·9	29·7	2·7	5	0·3	14·4	1	0·8	0·4	0·2	2·7	0·1	0	0·8

THE FUTURE OF AGRICULTURE IN THE SOUTH EAST AND THE METHODS OF ITS ORGANISATION.

PROFESSOR N. TULAIKOFF.

The Need for transforming the Systems of Tillage and Rural Economy.

EVEN before the war, and still more during the war, it had become obvious to local workers in the domain of agriculture that a change to new methods of tillage, a transformation of the whole rural economy, was essential.

The abundance of untilled land in association with a comparatively sparse population (the total area of Samara province is 14,231,900 desyatinas, of which according to the reports of 1916 there were sown 4,098,129 desyatinas; the total population of the province at that date was recorded as 3,053,854) and an extensive type of agriculture made it possible for Professor A. N. Chelintseff to assign Samara province to the region of "superabundant fallows." In his work *The Agricultural Regions of European Russia*[1] he writes: "We see a superfluity of fallows, interminable sowings of grain upon the newly broken land or upon the land which has been lying fallow; manure heaps, grass fields, no sign of root crops or tubers, fields and fallows positively drowned in perpetual grain crops. The production of cereals, ever more widely diffused, ousts stock-raising—though this is here of the utmost importance. The total area under grain continually increases."

From the point of view of the development of stock-raising this author assigns Samara province to the "petty cow-keeping, petty pig-keeping, petty sheep-keeping area." He means that the stock-raising, like the tillage, is carried on extensively not intensively.

The general condition of agriculture in this locality is dependent upon the climate as well as upon the great extent of uncultivated land. The Samara climate is very variable, being extremely dry in some years and very favourable to agriculture in others. This has encouraged haphazard methods of dealing with the land. The

[1] Selskohozyaistvennye Raiony Evropeiskoi Rossii, published in June, 1911; p. 131.

farmers have devoted their attention to the cultivation of summer corn, and in especial to the cultivation of summer wheat. According to the 1916 reports, the latter crop occupied 55 per cent. of all the sown area in Samara province. Thus, when seasonal conditions led to the failure of the summer corn crop, the whole agriculture of the locality was ruined, and the peasants were compelled to seek State aid if they were to live through the winter. Everyone will recall what happened in 1911, when Russian society had its attention riveted upon eastern Russia. The region had been devastated by a failure of the harvest, and the peasants had to invoke State assistance upon the grand scale.

I was then living in the centre of the affected area, and was myself a recipient of "food for the hungry." I had first-hand acquaintance with the conditions of this failure of the crops. At that time, with the aid of the data collected from experimental farms, I was endeavouring to work out a system through which the peculiarities of the local climate might be counteracted by peculiarities in the local methods of husbandry.

In my report to the Agricultural Conference in Samara, and to the Annual Congress of the Russian Agriculturists' Mutual Aid Society, held in Moscow in November, 1911,[1] I endeavoured to outline a system of husbandry by means of which the agriculture of Samara province would be enabled, with a fair prospect of success, to make headway against the extremely unfavourable climatic conditions of the locality. The leading thoughts of my report were as follows. First of all, it was essential to introduce a great diversity of crops into the farming lands of Samara province. Secondly, in arranging the rotation of the crops, it was essential to search for combinations in which the crops would be very various in respect alike of their rapidity of growth and of their need for moisture; they must also have a capacity for being turned to account in numerous ways in farm life. By means of such a combination of crops it would always be possible, however unfortunate the weather conditions might prove, to avoid the ruin of the entire harvest. Some of the crops would survive, and this would save agriculture from utter disaster.

At that date it had already become apparent that the

[1] Neurozhai 1911 goda i zadachi agronomii Yugo-Vostoka Evropeisko Rossii [The Failure of the Crops in the Year 1911 and the Agronomic Problems of the South East of European Russia], Moscow, 1912.

most reliable crops for the locality we are now considering were of the fodder kind. It was manifest that the transformation of the system of husbandry would necessarily lead to a complete revision of the rural economy of the area. Current events have merely confirmed our views as to the need for such a revision.

A Plan for the Transformation of Rural Economy.

The present condition of experimental science in the domain of agriculture renders it possible to engage in a struggle against the unfavourable peculiarities of nature in the South East of Russia. At the present time, the creation of improved experimental farms is notably facilitated by the fact that extensive prospects are opening up for stock-raising in the very near future. This development is fully accordant alike with the economic requirements of the situation and with the natural peculiarities of the area.

If a vigorous development of stock-raising in Samara province can and must provide the egress from the present situation, it is first of all essential to note the subordinate requirements of such a development and the direction in which the expansion must proceed. Whatever the perspectives which may be showing themselves in this matter as far as the future is concerned, the practical workers of to-day must study the happenings of the past, must be guided by experience. Then only can they form their plans for current work. Here, more perhaps than in any other department of our labours, it is necessary that we should be able with sufficient clearness to outline the prospects of the future, so that with perfect precision we may determine the practical steps which are necessary for the attainment of what may be called our working ideal.

Samara province occupies an immense tract of country lying lengthwise along the Volga. Its extent from north to south is about 800 versts, and from east to west about 450 versts. The natural conditions of the province are diversified. For this reason, the agriculture necessarily varies in different parts of the province. In the north, it is possible to look for an increased production of fodder from the land, so that this area can be utilised for dairy-farming and pig-keeping. In the southern and eastern parts of the province, where there are huge expanses of grassy steppe, we think rather of stock-raising for the meat supply, on the one hand, and of sheep-farming for the wool supply, on the other. The scheme we are about to outline cannot, of course, serve as a general

model for the reconstruction of rural economy throughout Samara province. Its task is different—to supply what may serve as the foundation of a purposive system of measures for this locality. Let us attempt to expound these initial steps.

The natural conditions, and in especial the extremely dry climate of Samara province, as far as agriculture is concerned, urgently impose the idea of an extensive diversification of the crops in order to avert the danger of complete failure of the harvest. Many data in support of our thesis have been furnished by the local experimental farms, but the practical experience of summers when the crops have failed is especially calculated to underline the accuracy of our views. The data of the experimental farms show, above all, that the contemporary methods of working the land can be greatly improved. This would lead to much more dependable harvests. The organisation of the local farmers would make it possible to place at their disposal sturdier varieties of crop, and (this is especially important) to introduce many different sorts of seed which have hitherto been little known to local agriculturists.

By a suitable rotation of his winter and summer crops, both as regards cereals and fodder, the farmer can with positive certainty ensure the fruitfulness of every corner of his land, with due regard to the climatic peculiarities of the year. This will enable him to guarantee the stability of his husbandry. Hitherto, however, there has been a definite obstacle, owing to the impossibility of adequately utilising on an individual farm the bulkier products of husbandry (such as root crops, tubers, maize, and hay), and owing to the extremely low prices obtainable for such products when offered for sale. In most cases they have had no market value because there have been no buyers. While the pre-war price of meat still prevailed, the farmer had no incentive to convert the products of husbandry into the products of stock-raising. As a consequence, he had no incentive to adopt a more intensive system of culture, one which would require more labour and more capital.

At the present time the fundamental objection is practically invalid. There is a widespread shortage of animal fats and albumens, a demand which cannot be met in the near future; but for this very reason high prices will reign for the products of stock-raising, and this will induce the farmers, whether individual or co-operative, to do all

in their power to adapt themselves to the needs of life. If, however, the development of stock-raising becomes the practical program of the farmers, the appropriate remodelling of the system of husbandry will be a simple matter. The system of tillage we are considering will undoubtedly involve the adoption of the more diversified crops which were discussed in previous paragraphs, and this in its turn will give greater stability, not only to husbandry, but to rural economy as a whole.

The farming industry of Samara province will then be able to supply the home market, and perhaps the foreign market as well, not only with wheat, but also with products which are more easily transportable and command a higher price—with meat, fats, wool, etc., for the production of which local natural conditions are extremely suitable.

Let us now try to sketch out a scheme for the future of farming in various parts of the province, availing ourselves for this purpose of the extant experimental material, which unfortunately relates only to husbandry. The data furnished by Bezenchuk experimental farm in Samara county may be regarded as applicable to those parts of the province, comprising about one-third of its area, where approximately similar natural conditions prevail.

The work of the Bezenchuk experimental farm has made it clear that by certain methods of tillage it is possible to secure reliable harvests of winter and summer corn, other products of the ploughed lands, and hay. The experiments have been conducted for a sufficiently long time to prove that we can choose, from among these various crops, series which will give a proper rotation. We are able to quote certain data relative to fertility.[1]

At the Bezenchuk Experimental Farm.

Winter rye .	Spring sowing .	114·5	Poods	1911—1916
Summer wheat	Sown in widely separated Drills.	71·7	,,	1909—1915
Oats . .	,, ,,	107·6	,,	1907—1915
Millet . .	,, ,,	110·1	,,	1909—1915
Maize . .	,, ,,	140	,,	1912—1915
Potatoes .	—	830	,,	1905—1915
Sunflowers .	—	101·5	,,	1913—1915

[1] Sm. Otchet Bezenchukskoi selskohozyaistvennoi opytnoi stantsii za 1915 goda, Vyp. VI. [Report of the Bezenchuk Experimental Farm down to the year 1915].

At the Bezenchuk Experimental Farm—continued.

French lucerne	Sown in widely separated Drills	205	Poods	1911—1914
Brome-grass .	—	200	,,	
Annual Fodder Growth :—				
Sorghum .	Weighed Green .	1,520	,,	1912—1915
Mogar .	,, ,,	1,072	,,	1912—1915
Chumiza .	,, ,,	1,030	,,	1912—1915
Gaelyai .	,, ,,	1,322	,,	1912—1915
Maize. .	,, ,,	1,340	,,	1912—1915

Above all it is important to note the great diversity in the harvest of cereal crops at the experimental farm. Speaking generally, the same thing applies throughout the province. We must not lose sight of the fact that in striking an average for the province we have included data from Nikolaevsk and Novouzensk counties, where the harvest is in general far more scanty than in the northern counties. In no case does the harvest exceed 50 poods of each cereal per desyatina, so that in the very best event there is secured barely half of the fertility attained in the fields of the experimental farm. This is especially true of summer wheat, which is a very unreliable crop upon the steppe land prevailing so widely throughout the province.

If, as the basis for the organisation of rural economy in the middle and northern parts of Samara province, we take the development of varieties of stock-raising to the degree which is demanded by contemporary economic conditions, and is, furthermore, indicated by the actualities of the physical conditions of the area and by vital conditions which though transient are nevertheless sufficiently stable, we shall find it necessary to plan the organisation of husbandry in such a way that there shall be an adequate amount of land planted with cereals. As part of the system of rotation of crops, we must undoubtedly include winter crops, for these are more dependable in our practical struggle with meteorological conditions. For a winter sowing we can as yet think only of rye, seeing that the researches at the experimental farm have not hitherto shown it to be possible to select for or to introduce into this part of Samara province hardy varieties of winter wheat, capable of enduring the winter of this locality, which is extremely cold, with little or no snow.

Among the groups of summer corn, together with the

ordinary summer wheat, which must constitute the main cereal crop, we might recommend the sowing, in poor (and not only in rich) soil, of hard or flint wheat [triticum durum]. For a long time, of course, the sowing of summer wheat will continue to predominate in Samara province, and the advantageous natural peculiarities of this grain are such that its extensive utilisation is of the utmost importance. Concomitantly with the reduction in the area of land lying fallow, the sowing of hard wheat almost entirely ceases, for the Samara farmer regards it as absolutely impossible to sow hard wheat except upon land newly employed for a wheat crop after it has been lying fallow or under a perennial grass. Indeed, the long-continued experiments at the Bezenchuk farm, and the experience gained upon the more progressive private farms of the locality, combine to prove the possibility of sowing hard wheat [triticum durum] in rotation not only upon land newly employed for wheat, but also upon poor soil, for instance upon the summer strip of the four-field area. Inasmuch as hard wheat fetches a considerably higher price than soft wheat in the local market, part of the wheat field can always be devoted to hard wheat as well as to soft; all that is requisite is that the farmer should pay attention to the possibility of improving his methods of sowing, and that he should be more assiduous in the struggle with weeds during the early days of the growth of the crop—for otherwise his wheat will have a poor chance.

The second matter of importance to local husbandry is the introduction of winter wheat among the sowings, side by side with winter rye. The local farmers have a special predilection for wheat; they are little interested in rye, and the latter grain, although it yields such reliable harvests, has never become well established on the farms of the central and southern parts of the province. For this reason it is essential to discover varieties of winter wheat resistent to local climatic conditions. If we could succeed in introducing a hardy kind of winter wheat, the farmers would be perfectly willing to sow it in their fallows. To grow winter rye, which fetches what the Samara agriculturists regard as a poor price, has not seemed worth while; but the price obtainable for winter wheat would be a sufficient inducement.

Oats is especially suitable for spring sowings in the middle portions of Samara province. It yields excellent and quite dependable crops. As far as the inauguration of stock-raising is concerned, we have to remember that

oats will meet the requirements of the local stock-farmers alike in the matter of grain and of straw. From this point of view, oat straw is far more valuable than wheat straw, and is especially useful in sheep-farming.

On the ploughed lands of this part of the province the most varied crops can be grown. First of all let us consider millet. Both millet and hard wheat [triticum durum] have hitherto been locally regarded as suitable only for virgin soil. Detailed study of the growth of millet has, however, shown that, with due care in sowing it (adequate attention to weeding in the early stages of growth), this grain can yield a stable and quite considerable crop. In the experimental farms of the locality there has been worked out a definite system of sowing (widely separated drills, single-line sowing and weeding-out between the drills) and of care for the millet. This results in very satisfactory crops. In Samara province, and generally speaking throughout eastern Russia, good qualities of millet command a very high price. At Sizran, in Simbirsk province, there existed before the war a considerable trade in the various grades of millet.

Among the cereals suitable for our corn lands, maize in particular has attracted the attention of the farmers in this part of the province. A comparatively short time has elapsed since the plant was introduced into Samara, but it has already recommended itself very strongly for the dry climatic conditions of the locality, on account of its drought-resisting qualities. A hindrance to its wide adoption in the farming of this part of the country has been the ignorance of how to use the grain when it has been grown, for maize has not hitherto formed part of the regular diet of the population. Maize can be used with great advantage for feeding pigs, kine, and horses. Its high fodder value in this respect opens extensive prospects for the cereal in the near future in connexion with the reconstruction of rural economy which is now beginning. Very remarkable are the uses to which maize is put in the United States. Much can be learned from American farmers should this staple be introduced into Samara province.

Among root crops and tubers, potatoes, mangold wurzels, and carrots are likely in the near future to attract the attention of the local farmers. According to the data furnished by the Bezenchuk farm, the potato can be successfully cultivated by comparatively simple methods. The ground does not need elaborate preparation. The

potato is easy to plant and requires very little care. The experimental farm has worked out a sufficiently detailed technique for the cultivation of potatoes, and has secured satisfactory results. The same remarks apply to the cultivation of mangold wurzels and carrots, which in the fields of the experimental farm have yielded crops ranging from 1,000 to 1,200 poods per desyatina. Hitherto potatoes have in Samara been cultivated only in kitchen gardens, while the mangold wurzel and the carrot are practically unknown in our fields, for these crops require much care and attention, and need to be intelligently used. The possibility of the latter is, of course, wanting in the case of primitive stock-raising, in the case of stock-raising of the consuming type; and the farmer has no adequate motive for the cultivation of fodder crops in his ploughed lands.

An additional difficulty is that these crops demand a considerable amount of labour, and that there has been no particular place for them in the prevailing system of farming. Of course, all these considerations will be modified by the organisation of a new type of rural economy, one which will imply the equal development of stock-raising and husbandry.

Among fodder crops, we may mention pumpkins, which yield excellent harvests, and are of great value for feeding horned cattle and pigs.

For the middle part of Samara province at the present time, French or Turkestan lucerne and brome-grass can be strongly recommended as fodder plants. These grasses have been studied for a considerable time at the local experimental farms, the ways of cultivating them have been worked out with sufficient care; their fertility has proved quite satisfactory, so that they may be assigned a definite place among the crops suitable for this locality.

As green fodder and for the pasturing of cattle, we can recommend various annual growths which provide feeds of every kind for farm beasts, and yield sufficiently good crops ranging from 1,000 to 1,500 poods of green stuff per desyatina.

Finally, among plants from which valuable products can be extracted, two may be mentioned; first of all sunflowers, which are already grown to a considerable extent in Samara province, and are likely to be still more widely diffused in the near future owing to the immense demand for oils; and secondly, the sugar beet, which is new to the locality, but which evidently has a great future. It is,

however, an overstatement to say that the sugar beet is quite new to Samara, for at the end of the last century it was extensively cultivated on the Timashevsk estate in the western part of Buguruslan county, for the use of the Timashevsk sugar refinery. The cultivation was abandoned owing to various difficulties of a technical and economic character, but the experience gained was sufficient to show that in this locality it is easy to grow sugar beets which yield a good crop and contain a sufficiently high percentage of sugar. Of late, the question of cultivating the sugar beet in the province has been revived, and in 1918 collective experiments were proposed, but the realisation of this scheme was frustrated by extraneous influences. The experiment of growing sugar beet on Bezenchuk experimental farm was a great success, and it is eminently desirable that the matter should be fully reconsidered. We must not forget the existence of two splendid sugar refineries (Timashevsk and Bogatovsk) in central Samara. These used to manufacture brown sugar.

In this manner the farmers of the central and northern portions of Samara province will be provided with a sufficient diversity of crops. By various combinations of these, in conformity with the general plans of their farming, they will be able to organise a suitable intensive rotation of crops, and will be in a position to guarantee for themselves stable results alike from ordinary husbandry (by the diversification of the crops) and from stock-raising (by the growing of suitable fodders).

This is not the place in which to recommend to the Samara farmers any specific rotation of the crops. The rotation of the crops is the reflection of a whole series of individual peculiarities of the farm and the farmer. From farm to farm and from farmer to farmer these vary enormously. Consequently the rotation of the crops must likewise vary greatly from one farm to another. Moreover, the decision of this question is exceptionally difficult at the present moment, inasmuch as the new forms of farming (communes, soviet farms, artels or co-operative farms, etc.) can take advantage of the experience gained in various kinds of large-scale agriculture, both in Samara and in other parts of Russia.

For the southern and eastern portions of the province there is a rather more limited choice of crops, for here the climate is characterised in winter by extreme cold and the absence of snow, and in summer by great heat and a very low rainfall. Furthermore, the land of this locality

is far less suitable for cereals, owing to the great quantity of salts in the soil. We must not, however, forget that wheat of good quality can be grown in Nikolaevsk county, and, in especial, in Novouzensk county. It is of the utmost importance that the technique of wheat sowing should be improved as far as possible. Extreme care must also be taken to maintain the right quantitative relationship between the sowings of cereals (which are comparatively unreliable in this locality) and of fodder crops (which are more dependable).

There is one advantage in this part of the world, as concerns the struggle with the drought which is the curse of local agriculture. The farmers long since began to have recourse to irrigation, and of late years (before the war) the practice had attained considerable proportions. Of course, the problem of improving the local soils assumes a prominent place in relation to the farming prospects of the locality, and this matter must receive due attention. But we must bear in mind that the area in question can never be very fruitful, for in the middle of Novouzensk county, where irrigation is especially needed, there are very few springs from which the requisite water can be obtained.

Whereas the climate of these parts of the province is comparatively unfavourable to the growth of cereals, the prospects of the development of fodder crops are far more hopeful. Among fodder crops we may count maize, for the successful cultivation of which suitable varieties must be introduced. Among fodders we think of brome-grass and yellow lucerne. Experience has been gained at two experimental farms of this locality, Krasnokutsk and Kostychevsk, furnishing positive data justifying the expectation of satisfactory results. The root crops suitable for fodder cannot be introduced in notable proportions into the ploughed lands of the area ; for any considerable development as far as they are concerned irrigation would be essential.

Thus the natural and the agrarian conditions of the southern part of the province indicate the need for a rural economy different from that of the northern part. In the south, undoubtedly, stock-raising will predominate, stock-raising of a comparatively extensive type. The cattle will be stall fed in the winter upon steppe hay, sown hay, and chaff ; and put out to grass in the summer and autumn.

Not being an expert in the subject of stock-raising, I

shall not try to specify the types of organisation in this domain of rural economy, but as an agricultural expert I should like to deal with the question from a general point of view. In the central parts of the province, and still more in the northern parts, it is obvious that special attention should be given to the promotion of dairy-farming, to the making of butter and cheese, and to the utilisation of the waste products of these manufactures in pig-farming. If there were considerable quantities of comparatively cheap cereal fodder for pigs, these animals being kept in conjunction with dairy stock, it would be easy to organise the rearing and fattening of pigs. Extremely interesting attempts have already been made in this direction. M. L. Frankfurt, the agricultural expert of the Samara county council, organised a co-operative creamery in the north of the county which collected milk from the peasants in Grachevk. When the creamery was broken up, some of the farmers that had been concerned in it established a five-field rotation of crops in conjunction with the growing of fodder in part of their ploughed lands. The creamery was very successful for a time, and similar co-operative undertakings began to develop before the war and in the first years of the war in Samara and Stavropolsk counties. There was even talk of building factories for the making of pork sausages, potted meats, and ham. For this purpose, funds were supplied by the Department for War Schemes of the Ministry for Agriculture, but the whole movement was arrested by the outbreak of the revolution.

In any event the ground is prepared. As soon as normal conditions of transport are restored, the area we have been considering, since it is excellently served by waterways and railways, will readily be able to send the products of stock-raising far beyond its own borders, and to supply the needs of large towns.

While engaged in the study of the local breeds of sheep, the workers at the Bezenchuk experimental farm have discovered, and have introduced into these parts of the province (Samara and Stavropolsk counties), certain varieties of Wallachian and Circassian sheep, possessed of notable qualities. The peasants and other local agriculturists have been supplied with whole flocks of these. Sheep-farming, alike in the northern and in the central parts of the province, can obviously become a matter of considerable moment, for, however the rural economy is organised, there will always remain consider-

able quantities of coarse fodder. These residues can be used for feeding sheep, animals which require the minimum amount both of fodder and care, and are by no means fastidious as to the local conditions. Doubtless in this locality sheep-farming will play only a modest part in the rural economy, for the population is rather thick on the ground for this branch of stock-raising. Moreover, the land is arable, and is suitable for crops which can provide feed for other kinds of live stock. There are, however, excellent possibilities in this part of the province for the organisation of the petty kinds of stock-raising—poultry-farming, for instance, which has already been attempted in various localities.

In the more southerly parts of the province, with vast though hitherto comparatively unproductive areas of steppe land in the form of pastures and meadows, the organisation of stock-raising must take another line. In addition to directing his attention to the possibility of getting milk of prime quality and noted for its richness in cream, the farmer will obviously be mainly interested in stock-raising for the meat market, inasmuch as the conditions are exceptionally favourable for the rearing of horned cattle and of sheep. The existence of drier sorts of feed, the sufficiency of steppe land upon which beasts can graze in the summer, the possibility of securing the necessary amount of coarse feed (straw and hay) in the winter, together with a supply of concentrated food-stuffs (oilcake and grain) for the later stages of fattening, combine to guarantee the possibility of an extensive development of this branch of stock-raising.

In addition to the fattening of horned cattle, there is obviously scope in the south and the east of the province, in the more favourable localities, for sheep-farming both for mutton and for wool. In fact, sheep-farming has of late played a considerable part in the rural economy of this area.

I shall not pause to consider in detail what are likely to be the results if the foregoing ideas are realised, if in the southern part of the province stock-raising is to assume, if not the predominant role in rural economy, at least a role co-equal with that of husbandry. The improvement of the local breeds with the aid of stud-farms, or in some other way; the building of commodious premises for the live stock; proper arrangements for railway transport in suitable trucks, cold-storage vans, etc.; improved slaughter-houses; arrangements for the adequate utilisa-

tion of the various waste products of the stock-farm—all these matters, all these politico-economical problems, must be dealt with in the way most accordant with local requirements. As an illustration of the sort of thing which must not be allowed to happen, I may mention the following incident connected with the transport of grain, which occurred just before the war.

Of the grain despatched to the Baltic ports for the foreign market, the average contamination with fouled grain was about 3 per cent., and the quantity of small, broken, and inferior grain might be as much as 7 per cent. If, therefore, from the grain exported from the province we were to deduct the amount which would be removed by proper sifting appliances (with which all the State elevators of Samara province are adequately furnished) as much as 10 per cent. of fouled and inferior grain would be set aside. All that is removed in the sorting can be very well utilised for the fattening of live stock, and would thus be transmuted into an extremely transportable form. However, before the war, the grain was sent unsifted from the Volga region to the Baltic, needing approximately 10 per cent. more rolling stock, while the quality and repute of Russian grain upon the foreign market were lowered.[1] It need hardly be said that if these parts of the State machinery were properly organised, such occurrences would not be tolerated. A more rational organisation of all branches of agricultural production upon a State scale must be one of the principal tasks of the governmental authority.

Turning to the question of the organisation of the whole rural economy of the population of Samara province, we must not fail to note that various parts of this province seem rather favourable to the development of such branches of husbandry as horticulture. Samara and Stavropolsk counties contain numerous orchards, and some parts of Samara county, especially Obsharovsk rural district, used before the war to send large quantities of apples, pears, and other fruit across the Urals. The attention of the population has perforce turned to the matter, and although there is no reason to expect extensive developments in this direction, in various parts of the province horticulture can play a considerable role in rural economy. In the southern part of the province the cultivation of other fruits assumes more importance. Here the greater quantity of light and heat and the com-

[1] During the years 1909 to 1913 the average annual export of grain from Samara province was about 92,000,000 poods.

parative dryness of the atmosphere make it possible to grow excellent melons and water-melons. Unfortunately the question of transport is a very troublesome one in the case of these bulky fruits, and it is desirable to utilise them on the spot by converting them into a syrup known as water-melon syrup, for which there is now a great demand owing to the scarcity of sugar.

When planning new forms for the rural economy of this area, as in all similar cases, we must not overlook the manners and customs of the population, or attempt to change these too rapidly. Hitherto, the peasant of this region has been a tiller of the soil, and nothing more, except that in the south he was something of a herdsman as well. He knew nothing of other occupations and trades. There was no dearth of utilisable land. Life did not demand much exertion from him for the simple task of ensuring a subsistence for himself and his family. In general, therefore, he did not put much labour into his farm.

Nowadays, of course, great changes have occurred in all the external conditions of life, but there is no particular reason to suppose that in the near future the local population will be inclined to devote more energy and time to farm work. Undoubtedly, laborious forms of husbandry will force themselves upon the local rural economy, but in the planning of all systems of farming the projector must reckon with the habits of the population, which can be changed only by degrees.

Consequently, in all our calculations for the future, we shall be compelled to provide for a notable increase in the use of machinery in farming, for this will enable us to economise considerably in human labour. Owing to the comparative sparseness of the population of this locality, the increase in the amount of sown land and the general introduction of more arduous methods of cultivation into husbandry, can only be effected in virtue of a fundamental change in modes of life. At the present time this is exceedingly plain. Agricultural machines are now wanted, not only by the soviet farms and communes, but also by the ordinary private farmer, who knows quite well how to make a good use of them. Already before the war, steam threshers were co-operatively owned by the peasant farmers. During the war, this system was yet farther extended. The ordinary farmers began to hire cutters-and-binders for the work on their farms, being unable to buy the machines for themselves. Under present

conditions, necessity has made the collective utilisation of agricultural machinery a rule of life, and this will familiarise the population with the idea of adopting similar methods when normal times return.

Measures requisite for effecting the Reorganisation of Agriculture.

In the purposive organisation of the measures whose essential aim it is to increase the productivity of the rural economy throughout Transvolgia, we must bear in mind the totality of measures tending towards this end. It would be futile to expect that the productivity of the land of this area will increase simply because we direct the attention of agricultural organisations to the improvement of the technique of husbandry, stock-raising, etc. The primitiveness of rural economy in Transvolgia (which prevailed before the war thanks, in great measure, to the ignorance of the rural population, and thanks also in part to the extremely difficult climatic conditions) really depended upon the existence of a definite trend in the general economico-political administration.

We may now expect a more reasonable regard for local needs. The time has come when we can turn our eyes towards the safeguarding of the purposive development of Transvolgia and towards the utilisation of the wealth of its productive forces. Agricultural production, rightly organised, presupposes a healthy co-operation on the part of the land, the labour, and the capital participating in production. In planning a system of measures for the improvement of agriculture in the locality, we must not overlook any one of these essential factors, and we must not fail to give each its due share of attention. It is obvious that these factors cannot all be included within the domain of the guidance of agricultural organisation; but it is no less plain that in default of the regulation of all the elements of production, we can hardly expect any one of the factors to produce its full effect.

Let us consider the land first of all. At the present time agrarian reorganisation must be the chief task of the central government and of its local organs.

Besides agrarian reorganisation in the strict sense of the term, serious attention must be given to every kind of improvement of the soil, beginning with the construction of the most elementary wells and watering places, and going on to large-scale irrigation schemes, especially in the southern area, which is extremely dry and very hot. In the Cisvolgian area, the organisers of agricultural improvements must devote serious attention to the radical amelioration of the hay lands which are annually flooded

by the rising of the Volga and its tributaries. At present the water-meadows of the Volga are of very little agricultural value, for no attempt at their systematic study and improvement has yet been made. However, the radical improvement of the flooded meadows lying along the Volga could play a considerable part in the development of stock-raising in this riverine strip, the population of which has for the most part been derived from the pastures and haylands of the steppes.

As regards the third factor in agrarian production, the main task of the government at the present time is assistance in the matter of capital, which here takes the forms of live stock, farming implements, and farm buildings.

The imperialist war and the civil war have everywhere played havoc with the weak organisations of agricultural capital. The requisition of draught beasts (oxen and horses), especially in 1920 when the war ravaged the area with which we are now specially concerned, has had a very injurious effect upon the local farms.

During these years, the farming implements have suffered even more grievously than the live stock. Whereas the natural increase in the live stock has to a certain extent compensated the war-time wastage in draught beasts and other farm animals, as regards farming implements (which for lack of machine shops in this area it has been impossible to repair) we may say that these have for the most part become utterly worthless.

Transvolgia presents everywhere an eager market for agricultural machinery. Not only have there been vast numbers of travellers in agricultural machinery going to and fro in Samara, but throughout the more thickly populated parts of the province the emissaries of all the Russian and foreign engineering works have made their way. Year by year, before the war, their enterprise in this respect was increasing.

The war interrupted the renewal of worn implements, and checked the natural growth of the demand. At the present time the agriculture of the locality is stagnant owing to the impossibility of satisfying the prevalent hunger for machinery.

It is essential that there should be an abundance of repairing shops, distributed throughout the area in accordance with a definite plan. These must render every assistance to the population in the repair and fitting of farming tools and machinery. Furthermore, all possible help must be given to small private workshops

for the repair of threshers, winnowing machines, etc. Such workshops can be organised quickly, though on a modest scale. They can give help to the local farmers, and can to some extent satisfy the pressing need for machinery.

During the war no repairs took place owing to the general difficulties of the situation; and, owing to the dearth of building materials the farm buildings were terribly neglected. At this time, the lack of imports of wood and other building materials into the province compelled the farmers of the steppes, generally speaking, to renounce all attempts at rebuilding or repair. In some cases, where the need for repair was extremely urgent, they were able to botch up matters with the use of local materials.

At this juncture, we could regard it as the best contribution to the success of any propaganda on behalf of the renovation of farm buildings, if, in conjunction with the propaganda, the population were to be supplied with the necessary building materials.

In this department of the rural economy of Transvolgia, I regard it as essential that there should be taken in hand the organisation and the regulation of the transport of harvest produce and of the products of stock-farming in the widest sense of the term. The difficulty of working an area which, though rich in agricultural products suitable for export, is badly served alike by waterways leading to the Volga and by railways; the extreme badness of the roads along which the grain has to be carted for tens or even hundreds of versts; the proverbial Russian mud on these roads; the no less proverbial telegas [Russian country carts] in which the grain is conveyed; the methods special to the locality by which the grain depots and the grain trade have been organised (methods now, it may be hoped, vanishing into the limbo of the past)—all these peculiarities of the way in which the harvests have been handled have in their day played a great part in determining the lot of the local husbandmen.

Hence it is absolutely indispensable that the Soviet Power should see to the organisation of the methods by which the produce of agricultural activity is disposed of; that the government should place the matter upon foundations which will be more purposive and more accordant with the needs of the State.

There must be an adequate provision of depots in the great trading centres, depots to which the farmers will naturally gravitate. There must be an adequate number

of elevators, properly supplied with machinery for cleansing the grain, and in some districts for drying the grain. The roads must be radically improved. Here are the indispensable conditions, which must be realised in the near future if the agriculture of this area is to be placed upon a rational foundation.

As far as concerns the transport of the products of stock-raising much not only could be done but must be done in the immediate future. The rolling-stock of our railways is not in a position to transport live beasts to the slaughter-houses of great cities. Large local slaughter-houses must be built, furnished with an up-to-date technical equipment, and providing for the full utilisation of all animal products, including the refuse (blood, bones, hair, horns, etc.). Cold-storage vans for the transport of meat, fat, and the other products of stock-raising, must be regular appurtenances of the railway transport system.

Nor must we overlook the installation of factories for the working-up of agricultural products on the large scale. In this connexion we think chiefly of flour-mills and creameries ; in the northern part of the province where potatoes are cultivated we think of distilleries ; and in the south it will be possible to instal beet-sugar factories. In connexion with potato growing, it is desirable to erect starch factories and glucose factories both on the small and on the large scale. In this direction, the local schools of agriculture have hitherto taken no steps, for, under the old regime, the organisation of the manufacture of agricultural products was left to the large private landowners. This matter must now be dealt with by co-operatives of small farmers, which must organise the business to the necessary extent, bearing in mind that only the manufactured products of local agriculture must be exported to an extraneous market, and that the waste products of these manufactures must be utilised by the peasants upon their own farms.

A fundamental factor in the agricultural life of the locality and one whose significance is especially manifest would seem to be its natural conditions, which down to the present have not been sufficiently studied. Consequently, the widespread inauguration of experimental farms in Transvolgia on the part of the government would appear to be urgently necessary. At these institutions it will be possible to undertake a detailed study of the environment ; to elaborate a series of rational measures for the struggle with unfavourable natural conditions,

and for the turning to full account of those conditions that are favourable. In the second place, in my view, comes the furnishing of expert agricultural advice to the population upon a scale proportionate to the needs of the moment. Neither as concerns the foundation of experimental farms nor as concerns the extension of their work, should the government be troubled by doubts or fears. Already, the agricultural experts of Samara province have secured a considerable amount of material firmly grounded upon experiment, and this they can unhesitatingly commend to the attention of agriculturists.

In addition to providing for an ample supply of expert advice to the population, the authorities must arrange for the widest possible diffusion of agricultural information, both scholastically and extra-scholastically. To this end all possible ways and means must be devised at the present juncture.

THE PROBABLE YIELD OF THE CROPS WHEN THE AGRICULTURE OF THE SOUTH EAST HAS BEEN RATIONALISED.

PROFESSOR V. N. BUSHINSKY.

Introduction.

THE statistical data of the harvests during recent years show clearly that in the south-eastern area in the course of every ten years there are at least two years in which the crops fail. Then, owing to the insufficiency of food and fodder, millions of persons and cattle go hungry. Some of the inhabitants endeavour to migrate to more fertile regions. Much of the agriculture of the affected area is completely ruined.

These periodically recurring crises, these failures of the harvest during many years, upset the established conditions of agriculture in the affected area, and at the same time they unsettle the whole agricultural system of the country, inasmuch as they withdraw the products of one of the most fertile granaries of the Republic from the general agricultural yield.

What systematic measures is it necessary to adopt in order that in the immediate future (and as far as the nature of the local soils, the climatic conditions of the area, and the contemporary achievements of science and technique permit) we may prevent the recurrence of such failures of the harvest? What crops is it expedient to introduce, what rotation of crops should we recommend, and so on, in order to save the vegetation from the effects of the customarily inadequate rainfall in the dry areas, and in especial from the consequences of the occasional extreme drought? What measures have we at our disposal for the preservation of the humidity of the soil and for a sufficient reduction of its salinity?

This essay is an attempt to answer such questions, and in especial it is an attempt to determine the probable yield of the crops when agriculture has been completely rationalised in all directions.

The area affected with drought in the eleven provinces

comprises nearly 170,000,000 desyatinas. Taking into consideration that in some of the provinces a continuous failure of the crops does not occur, we must reduce to 150,000,000 desyatinas, the area in all these provinces actually suffering from failure of the crops. This is 17 per cent. of the whole area of the eleven provinces. In a survey of these provinces we find a quite characteristic law for the distribution of population. As we pass from the North West to the South East, the area under cultivation and the density of population progressively diminish. The phenomenon is directly dependent upon the conditions of soil and climate.

Probable Yield of Crops in the South East.

To estimate the probable yield of the crops, our calculations must be based upon the data of considerable periods of time. Attention must be paid to numerous considerations. In especial we are concerned with the application, throughout the south-eastern area, of a carefully thought out and purposive system of agricultural production applied for a number of years.

This work is closely associated with another work, always interconnected with it in the arid south-eastern area. I refer to measures for the struggle with drought, infertility, and consequent famine. These matters fall under two heads: (1) failure of the crops and drought; (2) the consequences of failure of the crops and drought. And until the foregoing measures have been realised in the South East in a practical form, estimates of the probable harvests in this area will remain mere guess work.

At the present time we are already arranging to a sufficient degree for quite a number of experimental, scientific, and technical innovations. Though, of course, these are not yet in full working order, we are entitled to make a favourable forecast for the agriculture of the South East.

To this end it is necessary that new elements should be introduced into agriculture, that time-honoured and routinist practices should be discarded. We must seize the propitious moment for the introduction of the new and appropriate measures without which it would be idle to expect the rationalisation of agriculture. It is no less important to consider the factors of this transformation.

Among the desirable measures we must reckon (1): the utilisation of such results obtained in the experimental agricultural institutions of the South East as have already been placed on a secure foundation; (2) a careful study

of the area in respect of its physical, agricultural, and economic peculiarities; (3) a change in the system of husbandry; (4) the introduction as far as possible throughout the South East of the putting of land under pasture for several years in conjunction with rotation of crops; (5) the improvement of the methods of tillage and the adoption of those suitable to the local soils; (6) the cultivation on the ploughed lands of other crops besides cereals; (7) the restoration of fertility to the surface and to the exhausted deeper layers of the soil, and above all the breaking-up of the compacted masses and the renewal of friability; (8) the retention of moisture in the soil and its skilful utilisation; (9) the introduction of drought-resisting crops; (10) the waging of a struggle against the refractory physical and chemical qualities of the soil—measures for the cultural improvement of the salt lands and salt marshes; (11) the improvement of stock-breeding by the introduction of carefully selected breeders; (12) insuring that both in respect of design and of execution all the ameliorative measures adopted shall accord with a well-considered plan; (13) the inauguration of land settlement and land construction works, etc.

It is essential that all these measures should be carried out for a number of consecutive years in accordance with a definite system. The work in this region can be summed up as a struggle with the waterless steppe, as an extension of the area under cultivation by way of an increase in the putting of land under perennial grass, by way of the sowing of early-ripening crops on lands that have been lying fallow, and by way of the creation of oases.

Guided by the above considerations, and without introducing further details (for which space and time are lacking), we will draw up a general estimate of the agricultural production of this district.

The table on p. 63 shows clearly that even under the unfavourable conditions that obtain in arid south-eastern European Russia, agricultural production can be considerably increased at a moderate material expenditure within the course of a few years. We see that the yield can be raised to a level from 25 to 35 per cent. higher than the average yield of previous years. For the whole area of the eleven provinces the yield will become more than one milliard poods. As far as the arid south-eastern provinces are concerned (groups II. and III. in

Areas.	Tilled Land in Desyatioas.	Production in Thousands of Poods when Fertility has been increased by 25 per cent.	Increased Area of Land under Cultivation in Desyatinas.		Production of the enlarged tilled area in Thousands of Poods.
			+		
I. Kazan, Simbirsk, Vyatka, Ufa and Orenburg . .	9,445,001	522,756	10%	10,389,501	575,031
II. Samara, Saratov and Stavropol . .	8,667,925	371,653	20%	10,401,510	445,984
III. Astrakhan, Uralsk and Turgai . .	2,021,510	58,927	30%	2,627,963	76,605
Total of all the Areas .	20,154,436	953,336		23,418,974	1,097,620
Total of Areas in Groups II. and III. . .	10,689,435	430,680		13,088,443	522,589

the table) the yield will reach a total of more than five hundred million poods.

A yield according to these estimates would not merely suffice to feed the local population, to provide fodder for the beasts, and seed, in addition to furnishing a reserve of grain for any future period of failure of the crops. Furthermore, the yield of the whole area, and especially the increase in the crops in groups II. and III., would render it possible to export a considerable quantity of cereals from the South East, either for the home or for the foreign market.

We must point out that in three of the areas named, Astrakhan, Uralsk, and Turgai, no considerable increase in the extent of land under cultivation can be expected in the immediate future without a complete change in the system of husbandry. It is true that in these areas the amount of land under cultivation is very small, only 2,021,510 desyatinas, not more than 3 per cent. of the whole territory. In this part of the world, cattle-raising has hitherto predominated over agriculture, for the former is preferable in dry climates where harvest prospects are extremely uncertain. The association of all these things is quite possible, provided that the system of husbandry is changed and that new economic plans are adopted for the national agriculture.

In years of average harvest, Astrakhan alone among all the eleven provinces has, in general, suffered from any lack. It did not provide sufficient cereals for its own inhabitants, and the import of grain was therefore requisite. In 1917, for example, about 8,000,000 poods of cereals were imported into Astrakhan province.[1] There was a similar lack of grain in previous years. Regarding the other ten provinces few details are obtainable, but in years of average harvest they produce more than sufficient for local needs.

Samara, Saratov, Orenburg, and Ufa do especially well in this respect.

In Astrakhan province, and above all in the riverine area, notwithstanding the lack of cereal culture, there flourishes the intensive culture of vegetables, fruit, and flowers. Even to-day, these are produced in considerable quantities. This is rendered possible by the local conditions of soil and climate and by the abundant moisture in the riverine soil. The valley of the Volga and Akhtuba and the delta of the Volga form an oasis of flower, fruit, and vegetable gardens amid the encircling desert of the Caspian littoral.

In this area there are approximately 70,000 desyatinas under intensive culture in thoroughly well-watered land.

The whole area of the valley and the delta comprises nearly 1,600,000 desyatinas. The greater part could be used for the extension of flower gardens, vegetable gardens, melonries, vineyards, etc.

[1] Lositsky, The Russian Grain Harvest in the Year 1917.

AGRARIAN REORGANISATION.

Introduction.

WE shall consider the problem of agrarian reconstruction only as far as concerns the typically dry area of the South East. We shall deal with the provinces according to their old boundaries. Thus defined, Samara comprises 15,000,000 hectares; Saratov, 8,000,000 hectares; Astrakhan, 23,000,000 hectares; Turgai, 47,000,000 hectares; and Uralsk, 31,000,000 hectares. The whole area comprises 124,000,000 hectares.

After the revolution, about 97 per cent. of all the land of the above-defined area was concentrated in the hands of the peasant farmers and of the nomadic population. The remaining 3 per cent. was at the disposal of the instruments of State. According to the census of the year 1916, there were in the aforesaid territory, in all, 1,367,044 peasant farmers, and the total rural population was 7,900,000 persons of both sexes. According to the reports of 1920 the population last year had fallen to 7,200,000. The relative proportions of settled and nomadic population, with the respective amount of land they occupied, are shown in the following table :—

Settled agriculturists . .	5,881,000
Occupying . . .	39,400,000 hectares.
Nomads	1,319,000
Occupying . . .	84,600,000 hectares.

In the territory occupied by the nomads, the work of agrarian reconstruction has not yet begun. In the territory occupied by the settled population (inasmuch as the area was for a long time one of those directly affected by the civil war) the work of agrarian reorganisation did not begin until 1920. It then comprised preparatory measures of State activity on behalf of agrarian reorganisation upon a large scale. At the present time, in the riverine area, the work of agrarian reorganisation in the form of agricultural unification has been completed in ten rural districts with an area of 375,000 desyatinas.

The Tasks of agrarian Reorganisation.

The fundamental task of agrarian reorganisation is the overcoming of the existing insufficiency in the utilisation of the land, to the end that more favourable conditions

may be created. As far as the nomads are concerned, wherever the natural conditions render it possible, they should be gradually transformed into a stock-raising population settled on the land. As far as the settled peasant farmers are concerned, they must be guided to the adoption of more intensive methods of utilising the land, a change which will above all be associated with the abolition of the unduly close aggregation of the farmstead into huge villages. Simultaneously, agrarian reconstruction must pursue the aim of apportioning the surplus areas of free land in those regions where land is abundant so as to form a State colonisation land reserve for the population of those provinces of European Russia where land hunger prevails.

Benefits accruing to Agriculture from the Dispersal of the closely aggregated Farmsteads.

The huddling together of the population into closely set aggregates of farmsteads forming huge villages in the before-mentioned area is concentrated along the lines of the river Volga and its tributaries, and also in those parts which come within the influence of the railways. The general ratio of the villages comprising many farmsteads to the villages comprising few farmsteads (taking the latter at 200 farmsteads on the average) will be as 2 : 3. The transference per settlement will be 400 farmsteads.

The economic results of such a dispersal are obvious.

(1) If we assume that the size of the settlements is restricted to an area ranging from 1,500 to 2,000 desyatinas, this would reduce the distance of internal farming transport from 50—100 versts to 2—4 versts, this being a reduction of at least 25 times.

(2) The settlement enables the population to irrigate poor and salty soil.

(3) The increase in the area, the sowing of drought-resisting lucerne for fodder (experiments in Astrakhan province); experience shows that in this respect the ploughed land per settlement is increased 5 or 6 times, concomitantly with the reduction in transport.

(4) There spontaneously arises in the settlement a development of gardens, of the setting of trees; to a considerable extent, also, the cultivation of melons, cucumbers, etc., is undertaken.

(5) In the small settlements, ranging from 1,500 to 2,000 desyatinas, there is an improved rotation of the crops owing to the transition to a three-field or a four-field system, with sowings of lucerne, clover, etc.

(6) Stock-raising shows a strong tendency to be transformed from the keeping of herds on pastures to the

keeping of stall-fed beasts; in this way the supply of the animals with fodder is safeguarded, the transport of fodder is diminished, and there is less driving of cattle to and fro.

(7) The steppe becomes less arid, for the rainfall (especially the winter snowfall) is more rationally utilised by means of irrigation channels, etc.—by primitive methods which render it possible to equalise the distribution and expenditure of the stores of water, and definitely to increase the harvest.

A Plan of agrarian Reorganisation for a brief (Five Year) Period.

The plan of agrarian reorganisation includes the following items: (*a*) as far as concerns the Kirghiz and Kalmuck elements in the population, the marking-off of a land reserve for their especial use; (*b*) as far as concerns the peasant population, the breaking-up of the existing great settlements into a number of small settlements, each comprising from 1,500 to 2,000 desyatinas; (*c*) a systematic search for water in all the areas, the inauguration and carrying out of the simplest possible methods of regular water supply (wells, reservoirs, etc.); (*d*) the upkeep of the necessary high roads, the building of new bridges, and the repair of old ones.

Work for the realisation of these aims may be classed under three main heads.

I. Agrarian reorganisation in the agricultural areas where there is a superabundance of land, those in which part of the land can be assigned to the State colonisation reserve.

II. Agrarian reorganisation in the other agricultural areas.

III. Agrarian reorganisation in the areas inhabited by Kirghiz and Kalmuck nomads.

Under the first head comes an area of 15,000,000 hectares, distributed as follows:

Saratov . . .	2,800,000 hectares.
Samara . . .	2,000,000 ,,
Tsaritsin . .	2,800,000 ,,
Turgai . . .	6,000,000 ,,
Uralsk . . .	1,400,000 ,,

Out of these areas, 3,780,000 hectares can be assigned to the State reserve, as follows: [1]

Saratov . . .	500,000 hectares.
Samara . . .	700,000 ,,

[1] In two instances the above figures relate to the newly delimited provinces.

Tsaritsin . . .	730,000 hectares.
Turgai . . .	1,500,000 ,,
Uralsk . . .	350,000 ,,

Under the second head comes an area of 24,400,000 hectares, and under the third head an area of 88,600,000 hectares. The work in the third division, however, does not concern the entire area in question, but only those portions of it which are essential to the requirements of the existing nomadic population. Estimating this population at 1,319,000 of both sexes, or 263,800 kibitkas (tents—families), and the normal requirement of land per kibitka at 50 hectares, the amount of land required for agrarian reorganisation works out at 13,190,000 hectares.

Under the first head, the area annually dealt with in the work of agrarian reconstruction will amount to 3,000,000 hectares.

Amount of Materials and Labour annually required for the Realisation of this Plan.

	Hectares per Year.	Skilled Workers Needed.	Labourers Needed		Carts and Horses Needed	
			per skilled worker.	in all.	per skilled worker.	in all.
Surveyors . .	4,000	750	7	5,250	3	2,250
Hydraulic Engineers	30,000	100	20	2,000	4	400
Road Experts .	50,000	60	30	1,800	4	240
Totals .	—	910	—	9,050	—	2,890

Under the second head the area annually dealt with in the work of agrarian reconstruction will amount to 4,880,000 hectares.

	Hectares per Year.	Skilled Workers Needed.	Labourers Needed		Carts and Horses Needed	
			per skilled worker.	in all.	per skilled worker.	in all.
Surveyors . .	4,000	1,230	7	8,540	3	3,660
Hydraulic Engineers	30,000	150	20	3,000	4	600
Road Experts .	50,000	100	30	3,000	4	400
Totals .	—	1,480	—	14,540	—	4,660

Under the third head the area annually dealt with in the work of agrarian reconstruction will amount to 2,638,000 hectares.

	Hectares per Year.	Skilled Workers Needed.	Labourers Needed		Carts and Horses Needed	
			per skilled worker.	in all.	per skilled worker.	in all.
Surveyors . .	8,000	330	7	2,310	3	990
Hydraulic Engineers	60,000	45	20	900	4	180
Road Experts .	100,000	25	30	750	4	100
Totals .	—	400	—	3,960	—	1,270

The total annual demand for skilled and unskilled workers and for carts and horses under all three heads will amount to :

Surveyors	2310
Hydraulic engineers . .	295
Road Experts . . .	185
Total of skilled workers .	2,790
,, labourers . .	27,550
,, carts and horses	8,820

Financial Requirements.[1]

UNDER THE FIRST HEAD.

A. *Outlay on technical Work.*

	Per Hectare,		Annual Requirements for the 3,000,000 Hectares, in Roubles.	For a Five-Year Period, that is for 15,000,000 Hectares, in Roubles.
	Roubles.	Kopecks.		
Surveying . .	2	55	7,650,000	38,250,000
Irrigation Works .	1	30	3,900,000	19,500,000
Road Construction .	1	65	4,950,000	24,750,000
Totals .	5	50	16,500,000	82,500,000

[1] Cost estimated in gold roubles.

B. *Outlay necessary to provide the new Settlements with Buildings.*

	Cost per Building in Roubles.	Buildings Needed per Year.	Total Cost per Year in Roubles.	Total Cost for the Five-Year Period in Roubles.
Dwelling-Houses built of Clay, with tiled or thatched Roofs, and an Area of 90 square arshins . . .	300	20,000	6,000,000	30,000,000
Cowhouses, Stables, Pig-styes, etc., Barns, etc. —all with Lofts. .	100	—	2,000,000	10,000,000
Sheds for Farm Implements . . .	50	—	1,000,000	5,000,000
Totals .	450	20,000	9,000,000	45,000,000

N.B.—The above estimate of the buildings needed is based upon the following calculation. We suppose the normal share of land per head to be 7·5 hectares and the average family to consist of 5 persons. Per family, therefore, the amount of land required will be 37·5 hectares. Consequently, if every year the amount of land brought under settlement be 750,000 hectares, the number of families settled on this land will be 750,000 ÷ 37·5 = 20,000.

C. *Outlay for supplying the Settlers with Implements and Live Stock.*

Animals.	For one Family.			For 20,000 Families per Year, in Roubles.	For 100,000 Families in the Five-Year Period, in Roubles.
	Number.	Cost per head in Roubles.	Total in Roubles.		
Horses . . .	2	75	150	3,000,000	15,000,000
Cows . . .	1	50	50	1,000,000	5,000,000
Sheep . .	1	5	5	100,000	500,000
Rams . . .	1	5	5	100,000	500,000
Totals .	—	—	—	4,200,000	21,000,000

C. *Outlay for supplying the Settlers with Implements and Live Stock*—continued.

Implements.	For one Family.			For 20,000 Families per Year, in Roubles.	For 100,000 Families in the Five-Year Period, in Roubles.
	Number.	Cost per head in Roubles.	Total in Roubles.		
Ploughs	1	35	35	700,000	3,500,000
Harrows	1	25	25	500,000	2,500,000
Farm Carts	1	60	60	1,200,000	6,000,000
Sleds	1	25	25	500,000	2,500,000
Tools	1	25	25	500,000	2,500,000
Threshers	one for every five families	150	—	600,000	3,000,000
Harvesters		150	—	600,000	3,000,000
Horse-threshers		300	—	1,200,000	6,000,000
Winnowing-machines		50	—	200,000	1,000,000
Totals for Implements				6,000,000	30,000,000
Totals for Live Stock				4,200,000	21,000,000
Grand Totals				10,200,000	51,000,000

D. *Outlay for Supplying the Settlers with Seed.*

Area sown annually, in Hectares.	Seed for 1 Hectare in Poods.	Total Seed in Poods.	Cost of 1 Pood in Kopecks.	Total Cost per Year in Roubles.	Total Cost for the Five-Year Period in Roubles.
75,000	6	450,000	75	337,500	1,687,500

TOTAL OUTLAY UNDER THE FIRST HEAD:

for one year . . . 36,037,500 roubles.
for the five-year period . 180,187,500 „

It is desirable to add to this sum, for organising expenses, 25 per cent., which will give a revised total of 225,234,375 roubles.

UNDER THE SECOND HEAD.

A. *Outlay on technical Work.*

	Per Hectare.		Annual Requirements for the 4,880,000 Hectares, in Roubles.	For a Five-Year Period, that is for 24,400,000 Hectares, in Roubles.
	Roubles.	Kopecks.		
Surveying . .	2	55	12,444,000	62,220,000
Irrigation Works .	1	30	6,344,000	31,720,000
Road Construction .	1	65	8,052,000	40,260,000
Totals .	5	50	26,840,000	134,200,000

B. *Assistance given to the Settlers.*

Taking the quantity of population in the area of 24,400,000 hectares to be 2,000,000 persons or 400,000 farmers, and estimating the cost of the aid to each farmer at 250 roubles, we arrive at the following sum:

400,000 × 250 = 100,000,000 roubles.

Adding to this the sum of 134,200,000 roubles in the above table, we obtain a sum of 234,200,000 roubles.

Adding, as under the previous head, 25 per cent. for organising expenses, we reach a revised TOTAL OF EXPENDITURE UNDER HEAD TWO amounting to:

292,700,000 roubles.

UNDER THE THIRD HEAD.

A. *Outlay on Technical Work.*

Roughly estimating that the total cost for technical work under this head will be twice as much proportionally as the cost of the same work under the first and second heads, we find that the corresponding total cost for the area of 13,190,000 hectares will be 38,225,000 roubles.

B. *Outlay for Supplying the Nomads with Farm Implements.*

	For every 5 kibitkas.[1]		For 263,800 kibitkas.
	Number.	Cost in Roubles.	Cost in Roubles.
Machine Mowers .	1	150	7,914,000
Scythes . . .	5	10	527,600
Totals .	—	—	8,441,600

[1] Kibitka = tent, or family.

TOTAL COST OF WORK UNDER THE THIRD HEAD:

	46,666,600	roubles.
adding 25 per cent. for organising expenses . .	11,666,600	,,
Revised Total	58,333,200	,,

General cost under all three heads will thus amount, in round figures, to:

576,000,000 roubles.

Conclusion.

If the agrarian productivity of this dry area is to be increased, it is indispensable that all the before-mentioned measures for agrarian reconstruction should be put into operation. Any one of them, taken by itself, will be far from exercising a decisive influence. The fact that the locality lies within the area of inadequate rainfall dooms its peasant farming to the periodical recurrence of grave crises unless there be undertaken a series of widely conceived ameliorative measures in the form of irrigation works, unless the methods of husbandry be improved, and unless the whole rural economy be rightly organised.

In default of the preliminary realisation of these measures, any further colonisation of the dry area would merely serve to widen the basis for such catastrophes as this year's failure of the crops.

SOVIET FARMS IN THE SOUTH-EASTERN AREA.

N. V. TURCHANINOFF.

Number.

WITHIN the limits of the area affected by the failure of the crops of the year 1921 there are 654 soviet farms comprising 1,115,861 desyatinas, that is to say one-half of all the State lands of the R.S.F.S.R. actually at the present time incorporated in soviet farms. Out of this number in those provinces and regions classed in the first category as poor provinces, there are 377 soviet farms, comprising 959,695 desyatinas; and in the provinces classed in the second category there are 277 soviet farms, comprising 156,166 desyatinas.

In the various provinces and regions the distribution of the soviet farms and of the lands belonging to these is as follows:

First Category.

	Number of Soviet Farms.	Desyatinas.
Samara	109	136,000
Saratov	123	511,750
German Volga Commune .	5	12,000
Tsaritsin . . .	20	170,597
Astrakhan . . .	87	38,903
Chelyabinsk (part of Turgai)	33	90,445
Totals . . .	377	959,695

Second Category.

	Number of Soviet Farms.	Desyatinas.
Vyatka .	45	12,943
Kazan . .	93	37,064
Simbirsk .	73	23,394
Ufa . .	40	20,765
Orenburg .	26	62,000 (approximately)
Totals .	277	156,166

General Conditions.

Many of the soviet farms alluded to in the foregoing tables have not yet been inaugurated. The land is still to be surveyed and the farms exist only in embryo. This remark applies especially to the Transvolgian group of provinces, where vast areas have been assigned to the soviet farms, but where comparatively little has yet been done in the way of getting to work. For example, the Novouzensk belt has been handed over to the Gomza [State Machine Shops] to the extent of 452,358 desyatinas, and no more than 11,000 desyatinas of this are under cultivation. Out of the 170,597 desyatinas assigned to the soviet farms in Tsaritsin province, the greater part consists of steppe pasture land, and no more than 32,000 desyatinas are cultivated. In Astrakhan province, where horticulture is the predominant form of husbandry the cultivated land amounts to little more than 2,500 desyatinas.

Some of the soviet farms are very large estates, especially in Saratov, Samara, and Tsaritsin provinces, where they sometimes attain the size of 20,000 desyatinas or more, as for instance in Novouzensk, Melekesk, Leninsk, and Tsaritsin counties.

The largest soviet farm in Ufa province has an area of 2,200 desyatinas, but in the Iletsk county of Orenburg province all the soviet farms extend to 6,000 desyatinas.

The foregoing data show that in the impending survey on behalf of the restoration of the farms suffering from failure of the crops, great attention must be given to the large soviet farms of the locality, for these, if suitable methods are employed, can be transformed into undertakings which will not only give a satisfactory return from the productive point of view, but will be extremely advantageous to the whole region as examples of agricultural technique.

Farming Implements and Live.

As yet the work of these farms is only in the initial stage. They are engaged in setting their house in order, as we learn from the following figures. In the year 1920, in the six provinces classed in the first category as poor provinces, upon the 95,000 desyatinas of arable which are here under the administration of the Department of Agriculture, there were 5,657 cart horses, 3,495 oxen, and 204 camels, making up a total of 9,356 draught beasts. As far as the larger horned cattle are concerned, there were 5,544 head, and of these 3,028 were milch cows. Of smaller farm beasts there are 1,571 pigs, and 5,668 sheep.

The farming implements are shown in the following table:

Tools and Implements for breaking up new Land	3,826
Tools and implements for ordinary farm Work	6,626
Drillers	1,429
Harvesters	2,191
Threshers	236
Winnowing Machines	618
Tractors	5
Chaff-cutters, etc.	233
Separators	198
Churns	111

Sowings.

In these provinces, during the year 1920, there were sown 17,969 desyatinas, comprising 18·9 per cent. of all the arables of the soviet farms of the locality. Summer wheat was the principal sowing. Only in Saratov province was a considerable area (1,282 desyatinas) put under rye as a winter sowing.

Technical Equipment.

The second distinctive feature of the soviet farms in the Transvolgian provinces must be their adequate equipment with all kinds of technical apparatus, and in especial with mills, repairing shops, and smithies. Furthermore in nearly all the soviet farms there must be a number of factories for the elaboration of agricultural products. These can be set agoing at a comparatively low cost. They cannot fail to play a decisive part in the reanimation of the whole area, which is greatly in need of assistance in respect of the technique of these types of manufacture.

To sum up, in the plans for the restoration and improvement of the area affected by the failure of the crops in the year 1921, especial importance must be assigned to the soviet farms. As the foregoing considerations show, they offer splendid possibilities and are destined to play a dominant role.

THE NECESSARY IMPROVEMENTS IN THE SOUTH EAST.[1]

PROFESSOR A. N. KOSTYAKOFF.

Climatic Conditions of the South East: Water Supply.

THE south-eastern area of Russia has very marked peculiarities in respect alike of climatic conditions and of water supply. On the one hand we have a lack of humidity in the soil, and an uncertainty of the water supply in the summer, with all its consequences. On the other hand we have an excessive and utterly unprofitable flood of surface waters in the spring and during heavy rainstorms. These peculiarities of the south-eastern area impose the task of strict attention to the matter of water supply. The measures which should be adopted may be briefly summarised as follows: the regulation (by retardation, management, and storage) of the flow of surface waters (by reservoirs in the ravines and river beds); the right utilisation of the water, thus rendered available, for the tilling of the soil. By these measures would be secured: first, the extension of the area of cultivation, with a consequent increase in the humidity of the climate; secondly, the regularisation of the flow of the rivers. In this way it would be possible to cope with the most unfavourable among the natural conditions of the south-eastern area.

Improvements in the Water Supply.

The carrying out of these vitally necessary tasks involves a complete system of concrete measures for the improvement of the water supply in the south-eastern area. The most important of these measures will be the following:

(1) The storage of the rainfall and the snowfall in the localities where the fall takes place, whether in the highlands or in the lowlands, by special methods of snow-water retention and rain-water retention.

(2) The formation of lagoons in the straths and the wadis for the purpose of flooding the meadows and the hayfields. In addition to their use for irrigation by flooding *in situ*, the formation of these lagoons at the higher levels relieves the strain upon reservoirs lower down.

(3) The utilisation of the ravines in all possible ways, and especially by the building of dams in their higher

[1] For an explanation of the terms used in connection with irrigation schemes (lagoon, etc.), see p. 165.

parts, both for the storage of storm-waters, and for the safeguarding of the lower parts of the valley.

(4) The construction of embankments in the lower reaches of the valleys and also in the wadis and on the smaller, non-navigable streams; also the formation of great reservoirs where water can be stored for the irrigation of adjacent areas, either from natural heads of water or by pumping up water to attain the higher levels. These various works will place at our disposal a considerable quantity of water-power, of which adequate use must be made.

We see, then, that the main object of the system of measures above described is to retard the natural flow of the upland waters to the sea. In the spring, when the supply is abundant, these waters must be stored in special reservoirs, for use in summer, when there is a dearth of water, for the irrigation of the land. Only after this function has been fulfilled, only after the water has been used for agricultural purposes, should it be allowed to flow into the rivers and towards the sea. The water must not be permitted to make its way seaward until it has done its duty by the crops.

Such are the measures we have to employ for the distribution of the waters in the ravines, the wadis, the smaller, non-navigable streams, and the higher parts of the river basins. As far as the larger rivers are concerned, in their case likewise there is necessary a whole series of measures. These measures are connected with the general problems of the utilising of the rivers in agriculture (for navigation purposes, as sources of water-power, and in farming operations). Essentials to the regulation of navigation are: the construction of reservoirs for feeding the channels (when the waters are low); and the prevention of silting-up. Another part of the scheme, as concerns the larger rivers, is the use for irrigation purposes of such a part of their waters as is not essential to navigation.

Without pausing to consider in detail the utilisation of the south-eastern rivers for navigation purposes and their use as sources of water-power, we must emphatically insist that the full irrigation of all the land of the south-eastern area that is in need of irrigation for the complete development of its agricultural possibilities, cannot be achieved if we simply depend upon the winter rainfall and snowfall. In fact, the records show (see Table I. below) that the entire available amount of spring-time waters in Samara, Saratov, Astrakhan, and Uralsk, amounts in

average years to about 1,100,000,000 cubic sazhenes. If we suppose that one-fifth of this water is needed in order to keep the rivers navigable, and if we deduct this amount, there remains available for other purposes about 850,000,000 cubic sazhenes. Now there are needed for irrigation (direct irrigation and lagoon irrigation) and for the ordinary water supply of the area in question about 1,080,000,000 cubic sazhenes. Thus there is a deficit of nearly 250,000,000 cubic sazhenes. This means that about 500 desyatinas of land must remain unirrigated, unless we take water for the purpose from the rivers flowing through the area, to the amount of 25 cubic sazhenes per second.

The undertakings sketched in the foregoing paragraphs comprise in their totality a system of radical measures for dealing with the water supply of the South East. In carrying out this work of amelioration, we must proceed systematically and in accordance with a definite plan. We must give careful attention to details, whatever the demands upon our time.

Such are the ameliorative measures which are imposed by the natural conditions of the south-eastern area. Let us now turn to consider what sort of improvement works are demanded by the agricultural conditions and prospects of the South East.

Improvements in the agricultural Conditions of the Area.

The first place must be given to work for the restoration of existing agriculture and for the improvement of its conditions, and consequently to ameliorative measures tending towards the agrarian reorganisation of the local population—in the sense of a redistribution but not of an increase in the areas of extant agriculture. Work tending to promote the creation of a colonisation land reserve for the settlement of an immigrant population can be organised at the present time only in the form of preparatory studies and schemes for prospective undertakings, in so far as a skilled personnel and financial means are available.

In conjunction with this task—the improvement in the conditions of existing agriculture in the South East—there is necessary in the first place the introduction of the before-mentioned system of radical measures for the improvement of the natural conditions. Thus for the realisation of our aims, the following steps are requisite:

(1) Irrigation works taking the form of means for the retention of the snow-water and the rain-water in the fields of the catchment area and on the uplands—a region

in which this kind of work must be inaugurated on a large scale, as can be deduced from the following calculations. Observation and experiment (by P. V. Yankoffsk and others) have shown that good methods of irrigation can ensure in average years a grain harvest ranging from 20 to 35 poods per desyatina according as the local conditions vary. If we take the minimal annual production requisite per farm or family to be 50 poods of grain, we see that to guarantee this amount the average farm must have at its disposal from 1½ to 2½ desyatinas of irrigated land. Upon this basis we can calculate the number of farms and areas of the stated size needing irrigation works in each of the provinces under consideration. The total area where such irrigation works are requisite amounts to approximately 3,400,000 desyatinas in Samara, Saratov, Astrakhan, Uralsk, and Don Cossacks (comprising the more arid sub-area); and to approximately 2,800,000 desyatinas in Simbirsk, Orenburg, Penza, Ufa, and Kazan (comprising the less arid sub-area).

(2) The formation of lagoons for the flooding of the meadows and straths in an area of about 1,500,000 desyatinas in the five provinces where the conditions are those typical of the South East, and in an area of about 1,300,000 desyatinas in the adjoining provinces where the aridity is less marked. The extent of the lagoons is calculated upon the basis of what is necessary in the years of minimum rainfall for the watering of the live stock (horses and cattle) and for the growing of the requisite average amount of fodder. Detailed calculations for the various provinces will be found in Table II.

(3) Direct irrigation of the fields with water taken from: (*a*) reservoirs in the ravines and wadis; (*b*) in many cases, from the rivers and streams. The former method of obtaining water for irrigation is only now being inaugurated, and must henceforward be vigorously developed to the very limit of its possibilities. But, as has already been pointed out, the snow-waters will not suffice for the irrigation of the whole area which needs to be irrigated, and by degrees it will become necessary to have recourse to flowing waters and to distribute these waters through aqueducts, or in case of need with the aid of mechanical power. All this must go hand in hand with the development of intensive culture and with a general improvement in the economic conditions of the South East (communications, markets, etc.). The figures show that even in unfavourable years when the harvest

is very low, a direct irrigation system will serve in each of the provinces of the South East to make good the general requirements of the population; that is to say, the crops from the irrigated areas in conjunction with the minimal crops derivable from the non-irrigated sown areas will suffice to supply the minimum victualling needs of the population—namely, 8 poods of grain per head per annum —with sufficient over for seed corn. Table I. shows that the extent of ground requiring direct irrigation in the more arid sub-area, totals about 650,000 desyatinas; and in the less arid sub-area, totals about 400,000 desyatinas.

(4) The mechanical irrigation of areas under intensive culture (fruit, flower, and vegetable gardens; fields sown with fodder plants; and ploughlands) with the aid of artificially stored water distributed from pumping stations. The extent of this intensive culture in the more arid sub-area of the South East is as follows: fruit, flower, and vegetable gardens, about 233,000 desyatinas; sown hay and root crops, about 135,000 desyatinas. In the less arid sub-area, horticulture covers about 20,000 desyatinas, whilst hay and root crops occupy about 35,000 desyatinas. In the future, the extent of these kinds of cultivation must be greatly increased, and their development in the South East is a matter of State importance. The husbandry of the South East can only be stabilised by means of a sound system of irrigation. The land thus improved by irrigation must be consistently exploited by intensive methods, and this is tantamount to saying that favourable results can be secured only by intensive culture. Then there will be in the South East an abundance of vegetables, fruit, and flowers; lucerne and sugar beet will be grown. The last-named may be regarded as especially suitable for the irrigated areas. The total extent of mechanically irrigated land under intensive culture (horticulture, haylands, root crops) will amount in the more arid sub-area to about 330,000 desyatinas, and in the less arid sub-area to about 70,000 desyatinas.

(5) The inauguration of a system of direct irrigation in the South East, in conjunction with the institution of large numbers of reservoirs for the storage of rain-water and snow-water, particularly the latter. The ratio between the irrigated areas and the reservoirs must be such that for each storage unit of from 400 to 600 cubic sazhenes there must be one desyatina of irrigated land. Apart from their function in the matter of irrigation, the reservoirs are likewise needed for the purposes of ordinary

water supply, the watering of farm stock, combating fire, etc. The total requirements of the locality for water for such purposes, in view of the number of persons and farm beasts to be supplied, may be estimated at approximately 27,000,000 cubic sazhenes of water per annum in the more arid sub-area, and approximately 21,000,000 cubic sazhenes in the less arid sub-area. Consequently, the work under this head consists of the building of reservoirs in the wadis and ravines for the collection and storage of the waters when freshets occur—and this will serve in addition to prevent the occurrence of wash-outs. The total number of these reservoirs will amount, in the more arid area, to 11,400, of which 8,000 will be comparatively small; and in the less arid sub-area will amount to about 7,000. The number required will be proportional to the degree of immigration into the various provinces.

(6) Various other engineering works connected with the making of reservoirs are required in the ravines. We need not lay much stress upon their importance to agriculture, but nevertheless such work will prove of great value in the struggle with drought. The ravines, like drainage canals, are responsible for a great drying of the soil. They cause a fall in the level of the ground water; through them large quantities of water run to waste; they lead to wash-outs; and they lead to the silting up in the river beds. We have to bear in mind how thickly set the ravines are in all these provinces, that from one-fifth to one-third of the whole catchment consists of ravines, that the total length and the number of them are considerable in every one of the provinces. The total number of the ravines in the more arid sub-area is over 33,000, and in the less arid sub-area it is over 20,000. Engineering works are needed in them all. Full numerical details for the various provinces and regions are given in Table I.

(7) The regulation of the flow of the rivers and streams of the area, the clearing of their channels, the utilisation of their water-power, are further essentials, together with the construction of reservoirs and the use of river water for irrigation. From one-seventh to one-fifth of the total length of the streams and rivers is in need of such regulation. The particulars given in Table I. show that the length for which regulation is required amounts to about 6,000 versts in the more arid sub-area, and to about 8,000 versts in the less arid sub-area.

(8) Work of great importance is the provision of good

drinking water throughout the locality, by the sinking of wells. The number of wells can be definitely calculated upon the basis of the assumption that on the average one well will be required for 50 farms. We find, therefore, that for the more arid sub-area about 33,000 wells will be needed, and for the less arid sub-area about 37,000.

(9) Finally, when we are considering work for the improvement of the South East, certain special points must not be overlooked. Such are the following: (1) improvement of the salt lands and salt marshes, which are found in great numbers in various parts of the South East; (2) drainage and irrigation works in the extremely rich and fertile soil of the Volga delta, and the delta regions of the Don and the Aksai; (3) measures for dealing with the sandy areas of Astrakhan province. In so far as these areas contain land capable of being put to immediate use, their improvement must form part of our general plan. For the most part, especially in the case of the shifting sand hills and sand dunes, these areas may be the object of colonisation in the future. More will be said of this matter below.

Scale of the Work.

We have given a general sketch of the most important ameliorative measures essential to the regulation of the water supply of the locality, to ensuring a stable supply even in times of drought, and to the safeguarding of the agriculture of the area. We have confined ourselves to the consideration of the most essential needs. The various measures requisite are summarised in the following table:

	The more arid Sub-Area, comprising Samara, Saratov, Astrakhan, Uralsk, and Don Cossacks.	The less arid Sub-Area, comprising Simbirsk, Penza, Ufa, Kazan, and Orenburg.
(1) Irrigation Works, mainly for the Fields	3,400,000 Desyatinas	2,800,000 Desyatinas
(2) Lagoon Irrigation, mainly for the Meadows	1,500,000 ,,	1,300,000 ,,
(3) Direct Irrigation of Ploughlands	640,000 ,,	400,000 ,,
(4) Mechanical Irrigation of Land under intensive Culture	330,000 ,,	70,000 ,,
(5) Construction of Reservoirs of various kinds	11,400 Reservoirs.	700 Reservoirs.
(6) Engineering Works in the Ravines	33,000 Ravines.	20,000 Ravines.
(7) The Regulation of the Flow of the Streams and Rivers	6,000 Versts.	8,300 Versts.
(8) Supply of drinking Water for the Settlers	33,000 Wells.	37,000 Wells.

The work specified above comprises the totality of the ameliorative measures indispensable for the improvement of the conditions of agriculture in the South East and in order to provide it with the requisite stability. We see that the amount of the proposed work, even although we contemplate nothing beyond what is absolutely indispensable, makes up a very large total. We have before us a great and arduous task, especially in view of the disastrous condition of agriculture at the present time. For the carrying out of these extensive undertakings, no less extensive means will be required. In the subjoined table an attempt has been made to specify the principal requisites for the completion of the measures above-described. The calculations relating to the amount of excavation, etc., needed for the construction of reservoirs and for direct and lagoon irrigation, show that, in order to obtain a reservoir storage capacity ranging from 15 to 25 cubic sazhenes and a lagoon storage capacity ranging from 25 to 30 cubic sazhenes, 1 cubic sazhene of dam or embankment must be built. The quantity of excavation required per desyatina of irrigated land ranges from 13 to 17 cubic sazhenes. Thus the total amount of excavation work needed amounts in the more arid sub-area of the South East to about 64,000,000 cubic sazhenes, and in the less arid sub-area to about 41,000,000 cubic sazhenes. For this extensive work of excavation there will be required in the more arid sub-area about 370 excavators of 100 h.p. each, and in the less arid sub-area about 148 similar excavators. Among the various mechanical appliances requisite for the installation of these irrigation works are: (*a*) pumps (mainly centrifugal pumps), with a diameter ranging from 4 to 6 inches—of these 38,000 will be needed, 32,000 for the more arid and 6,000 for the less arid sub-area; (*b*) hydraulic rams, 10,800 in all (9,100 for the first sub-area, and 1,700 for the second); (*c*) motors with a total h.p. of 109,000 (90,700 h.p. for the first sub-area, and 18,300 for the second); a total number of motors (2 to 4 h.p. each) 38,300 (32,300 for the first sub-area and 6,000 for the second).[1] About one-third of the motors must be wind-driven, since this will be more adapted to the purposes of irrigation.

[1] The quantity of energy required per desyatina ranges from 0·2 to 0·3 of a h.p. per second, bearing in mind that in the basic American experiments for the application of small motors to irrigation, in actual work in the fields the power secured was 3 to 4 times less than the indicated h.p.

Material and technical Requirements.

For boring the wells there will be needed about 165 sets of boring apparatus in the more arid sub-area, with about 340,000 sazhenes of iron piping from 2 to 4½ inches in diameter; and in the less arid sub-area about 169 sets of boring apparatus with 380,000 sazhenes of iron piping. There will be needed for the wells a corresponding number of pumps, etc.

For the building of the dams (their waste-weirs and sluices), and for the construction of the irrigation system, we shall require large quantities of building materials, the chief of which can be roughly estimated as follows:

	The more arid Sub-Area.	The less arid Sub-Area.
Cement	28,000,000 Poods.	16,000,000 Poods.
Metallic Materials other than Iron	2,800,000 „	2,000,000 „
Timber Props of various Thicknesses	4,000,000 Pieces.	3,000,000 Pieces.
Planks	15,000,000 „	9,000,000 „
Lime	1,500,000 Poods.	1,000,000 Poods.
Tiles	550,000,000 Pieces.	350,000,000 Pieces.
Iron for various Purposes	1,200,000 Poods.	700,000 Poods.

For each kind of investigation connected with the realisation of these schemes there will be requisite a number of instruments of precision, such as meteorological and hydrometric appliances and surveying apparatus. A sufficient quantity of such instruments is not obtainable in Russia at the present time, so they will have to be imported; this applies also to the draughtsmen's requirements (paints, paper, drawing materials, etc.). The quantities of these various articles can be estimated as follows: (1) hydrometers for 1,000 versts of river beds; (2) 1 goniometer and 2 levels for every 50,000 desyatinas of land to be irrigated; (3) 1 plane-table for every 100,000 desyatinas; (4) 1 draughtsman's set for every 50,000 desyatinas; (5) 1 set of meteorological apparatus (for stations of the second grade) for every 10,000 desyatinas of land to be irrigated. See Table II.

Consequently, in order that the above-described ameliorative measures may be carried out in full, the following amount of work will have to be done, and the following materials and technical requisites will be needed:

	The more arid Sub-Area.	The less arid Sub-Area.
Quantity of Earth to be excavated	64,000,000 Cub. Sazh.	41,000,000 Cub. Sazh.
Number of Excavators	371	148
Number of Pumps	32,000	6,000
Number of hydraulic Rams	9,000	17,000
Number of Motors from 2 to 4 h.p.	20,000	4,000
Number of Wind-driven Motors	10,000	2,000
Boring Apparatus	165 Sets.	169 Sets.
Iron Piping, 2″ to 4½″.	340,000 Sazhenes.	380,000 Sazhenes.
Number of Pumps, etc., for Wells	32,000 ,,	6,000 ,,
Building Materials.		
Cement	28,000,000 Poods.	16,000,000 Poods.
Lime	1,500,000 ,,	1,000,000 ,,
Iron for various Purposes	1,200,000 ,,	700,000 ,,
Other Metallic Materials	2,800,000 ,,	2,000,000 ,,
Timber Props of various Thicknesses	4,000,000 Pieces.	3,000,000 Pieces.
Planks	15,000,000 ,,	9,000,000 ,,
Tiles	550,000,000 ,,	350,000,000 ,,
Instruments of Precision.		
Hydrometers	60	49
Goniometers, Levels, and Plane-Tables, in all	381	276
Meteorological Apparatus	93 Sets.	50 Sets.

Arrangement of the Work.

Here we have a general statement of what is necessary for the realisation of the program that has been outlined above, of what will be required for the ameliorative measures which are to restore the life of the South East and to improve its rural economy. Only by degrees can such a program be realised. Work to this end must proceed along two lines. The first thing is to devote ourselves in each province to the most vital and immediately pressing tasks, which for the more arid sub-area range from 30 to 50 per cent. of the projected schemes (average 40 per cent.), and for the less arid sub-area range from 20 to 40 per cent. (average 30 per cent.). Then only can we attempt the remaining tasks. In order to arrive at an estimate of the work immediately necessary, we must take 40 per cent. or 30 per cent. (as the case may be) of

the above totals. Since it will require five years to complete the whole of the work requisite under the first category (immediately necessary tasks) the average amount of work to be done each year can be calculated as follows:

Variety of Work.	More arid Sub-Area.	Less arid Sub-Area.
(1) Irrigation Works	250,000 Desyatinas.	160,000 Desyatinas.
(2) Lagoon Irrigation	120,000 ,,	70,000 ,,
(3) Direct Irrigation	45,000 ,,	24,000 ,,
(4) Construction of Reservoirs	900 Reservoirs.	400 Reservoirs.
(5) Engineering Works in the Ravines	2,000 Ravines.	1,200 Ravines.
(6) Regulation of Flow of Rivers	450 Versts.	550 Versts.
(7) Mechanical Irrigation	25,000 Desyatinas.	5,000 Desyatinas.
(8) Supply of drinking Water	2,000 Wells.	1,200 Wells.
Annual Cost	27,000,000 gold Roubles.	12,000,000 gold Roubles.

As far as concerns in each year the choice of the places at which work is to be done in each province or region, we must be guided by local needs and demands, without departing from the general plan. At this juncture it is impossible to formulate a specific plan for the work in each province or region, and we will only say a few words as to colonising work in the South East. The inauguration of a colonisation land reserve constitutes the second main department of the ameliorative work in the South East. In this respect much has been done, and there are certain materials for the before-mentioned work. Matters are still in the investigatory stage, and the first lines are being laid down.

As is evident from all that has been said above, the amount of work requisite for the improvement of conditions in the South East is enormous. The carrying out of what is wanted is hampered, not only by the dearth of material means, by the lack of instruments, etc., but also by the insufficiency in the supply of technicians. Consequently, when we contemplate a far-reaching scheme of improvements in the South East, it is essential that we should consider how to provide the necessary number of skilled workers; not only the experts-in-chief, but also the middle and lower grades of the skilled personnel, of which latter

a very great number will naturally be needed. It is further necessary to create locally a powerful technical apparatus for theoretical and practical purposes, making the best use of the available authorities, in order to execute the foregoing program in its totality.

The Tables which follow deal with the natural features of the South East (Table I.), and the quantitative requirements for the proposed ameliorative work (Table II.).

Table I.

Name of Province or Region.	Supply of Spring-time Waters in Cubic Sazhenes.	Ravines.			Streams.			Irrigation Works in the Fields.	Irrigation.			Lagoon Irrigation of the Meadows.	Supply of Water from Reservoirs in Cubic Sazhenes.	Number of Reservoirs.	Storage Capacity in Cubic Sazhenes.	Total amount of Water needed for Irrigation, in Cubic Sazhenes.	Snow-Waters available in average Years for Irrigation Purposes, in Cubic Sazhenes.	Number of Wells needed.
		Coefficient.	Length in Versts.	Number.	Coefficient.	Length in Versts.	Need Regulation.		Direct.	Mechanical (Horticulture).	Mechanical (Agriculture).							
MORE ARID SUB-AREA								in desyatinas.										
Saratov	330,000,000	0·75	18,000	14,000	0·12	8,905	1,500	800,000	200,000	20,000	35,000	200,000	5,000,000	2,150	105,000,000	280,000,000	20,000,000	8,700
Samara	490,000,000	0·5	16,000	11,000	0·10	13,270	2,000	1,200,000	280,000	40,000	70,000	400,000	7,000,000	2,000	147,000,900	462,000,000	86,000,000	10,500
Astrakhan	130,000,000	—	—	—	0·03	1,640	250	540,000	142,000	35,000	—	200,000	4,000,000	550	70,000,000	205,000,000	120,000,000	4,000
Uralsk	145,000,000	0·1	1,800	1,500	0·03	1,860	300	115,000	35,000	10,000	1,000	200,000	3,000,000	400	21,000,000	132,000,000	20,000,000	900
Don Cossacks	720,000,000	0·2	8,000	7,000	0·10	15,000	2,000	800,000	—	100,000	25,000	600,000	8,000,000	8,000	8,000,000	420,000,000	180,000,000	9,000
Totals	—	—	43,800	33,500	—	40,675	6,050	3,455,000	657,000	205,000	131,000	1,600,000	27,000,000	13,100	351,000,000	1,499,000,000	426,000,000	33,100
LESS ARID SUB-AREA.																		
Simbirsk	350,000,000	0·4	5,000	4,000	0·16	8,960	1,000	600,000	90,000	7,000	5,000	160,000	3,000,000	1,500	48,000,000	188,000,000	115,000,000	6,000
Penza	220,000,000	0·4	4,000	3,000	0·16	5,530	900	400,000	60,000	5,000	10,000	200,000	3,000,000	1,500	33,000,000	122,000,000	68,000,000	5,600
Kazan	370,000,000	0·4	5,000	4,500	0·15	8,550	1,400	500,000	20,000	1,500	1,500	120,000	4,000,000	2,000	14,000,000	112,000,000	230,000,000	8,900
Ufa	530,000,000	0·2	5,000	4,000	0·13	13,000	2,000	740,000	40,000	2,000	8,000	230,000	6,000,000	1,500	26,000,000	185,000,000	300,000,000	10,000
Orenburg	900,000,000	0·2	8,000	5,000	0·12	20,040	3,000	620,000	190,000	20,000	10,000	500,000	5,000,000	1,500	125,000,000	420,000,000	400,000,000	6,800
Totals	—	—	27,000	20,500	—	56,080	8,300	2,860,000	400,000	35,500	34,500	1,210,000	21,000,000	8,000	246,000,000	1,027,000,000	1,113,000,000	37,300

Table II.

Name of Province or Region.	Quantity of Earth to be excavated, in Cubic Sazhenes.				Number of Excavators of 100 h.p	Number of Pumps of 4 to 6 h.p.	Number of Rams of 5 to 8 h.p.	Total Horse-Power of Motors.	Number of Motors of 2 to 4 h.p.	Sets of Boring Apparatus.	Iron Piping in Sazhenes.	Instruments of Precision.					
	Reservoirs.	Lagoons.	Direct Irrigation.	Totals.								Hydro-meters.	Meteoro-logical Apparatus.	Gonio-meters.	Levels.	Plane-Tables.	Draughts-men's Sets.
MORE ARID SUB-AREA.																	
Saratov . . .	5,500,000	4,000,000	3,825,000	13,325,000	90	5,500	1,500	18,000	5,500	43	90,000	15	25	25	50	13	25
Samara . . .	7,500,000	8,000,000	5,850,000	21,350,000	142	12,000	2,000	30,000	12,000	52	110,000	20	38	34	60	17	35
Astrakhan . .	3,500,000	4,000,000	2,550,000	10,050,000	67	3,600	400	9,000	3,600	20	40,000	5	17	20	35	10	20
Uralsk . . .	1,000,000	4,000,000	690,000	5,690,000	25	1,200	200	2,700	1,200	5	10,000	5	5	8	15	4	8
Don Cossacks . .	800,000	12,000,000	1,125,000	13,925,000	47	10,000	5,000	31,000	10,000	45	90,000	15	8	30	45	15	30
Totals .	18,300,000	32,000,000	14,040,000	64,340,000	371	32,300	9,100	90,700	32,300	165	340,000	60	93	117	205	59	118
LESS ARID SUB-AREA.																	
Simbirsk . .	2,400,000	3,000,000	1,530,000	6,930,000	30	1,100	400	3,000	1,100	30	60,000	7	10	18	30	9	18
Penza . . .	1,700,000	2,000,000	1,120,000	4,820,000	16	1,100	500	4,000	1,100	25	60,000	5	8	12	20	6	12
Kazan . . .	750,000	2,500,000	340,000	3,590,000	16	300	100	800	300	40	90,000	9	2	12	20	6	12
Ufa . . .	1,200,000	4,600,000	750,000	6,550,000	21	700	300	2,500	700	40	100,000	12	5	20	35	10	20
Orenburg . .	6,000,000	10,000,000	3,700,000	19,700,000	65	2,800	400	8,000	2,800	34	70,000	15	25	25	40	13	25
Totals .	12,050,000	22,100,000	7,440,000	41,590,000	148	6,000	1,700	18,300	6,000	169	380,000	48	50	87	145	44	87

IRRIGATION WORKS FOR THE SOUTH EAST IN THE BASINS OF THE GREAT UZEN, THE LITTLE UZEN, AND THE KUSHUM.[1]

PROFESSOR R. P. SPARRO.

Basins, Rainfall, and Soil.

THE basins of the Great Uzen, the Little Uzen, and the Kushum form part of the territory where the rainfall is insufficient, and are situated in the semi-desert area. The annual rainfall ranges from 10 inches (in the west) to 6 inches (in the south east). Even this low rainfall is extremely irregular. The soils are for the most part chestnut-brown clays; here and there we find salt lands, sometimes alternating with sand (in the south east). The whole area is a plain with a gentle slope southward towards the Kamysk and Samarsk Lakes. The two Uzens simply cut their way into this plain, forming cañons without valleys or alluvium. In the spring, when the snows melt, these two rivers carry a great deal of water. The Kushum, on the other hand, which is an offshoot of the Ural, receives only a moderate amount of water from the Ural even in years when the main river is high, while in years when the Ural is low hardly any water enters the Kushum.

The ground water in this locality is for the most part strongly saline, and it is therefore of very little use to the inhabitants. The watering of this area depends mainly upon reservoirs for the storage of snow-waters. In addition, the settlements and farms lying along the before-mentioned rivers, make use of the water which is left behind in pools in various reaches of the rivers after the spring freshets.

Agricultural Conditions in the Basins.

The unfavourable climatic conditions have determined here the course of extensive agriculture. In the western parts of the area, however, a considerable proportion of the land has been brought under the plough; but as we pass eastward and south-eastward we find that the extent of the ploughed lands diminishes, and that the virgin steppes are used as hayfields and as pastures for stock-

[1] For an explanation of the terms used in connection with irrigation schemes (lagoon, etc.) see p. 165.

farming. Quite a long time ago, nevertheless, the inhabitants of the region we are now considering recognised the enormous importance of irrigation. In the forties of the last century they began this practice, first irrigating their meadows, then their vegetable gardens, and subsequently, their corn-fields, depending upon the meagre resources obtainable from the local rainfall. At the present time there are thousands of farms, with a total area of more than 30,000 desyatinas, where the little gardens and vegetable gardens are irrigated with the aid of norias (paternoster-pumps or chain-pumps) or of ordinary pumps driven by internal combustion engines, the water being drawn from the aforesaid river pools or from the snow-water reservoirs. In addition, in many localities, the ploughed lands and the meadows are artificially flooded for brief periods (lagoon irrigation). The settlement of the desert areas and the development of stock-raising depend here exclusively on the supply of water; wherever there is a spring, there we find a farmstead; wherever reservoirs for snow-waters have been made, there stock-raising has developed. Thus in this part of the world irrigation and artificial watering are not new undertakings; the local population has long been familiar with them, and for their further development the only requisites are the regulation of the flow and the proper distribution and storage of the snow-waters.

We must not forget that the Krasny Kut, Novouzensk, and Alexandrov Gai railway traverses the area.

In consequence of the scantiness of the local rainfall, attention has for a long time been turned to the vigorously flowing waters of the Great Uzen and the Little Uzen, and also to the waters of the Kushum which could be made available for irrigation with the aid of modern engineering skill.

Irrigation Works.

The catchment of the Little Uzen comprises about 9,000 square versts, and the length of the river is 500 versts. The scheme contemplates the building of seven embankments which will lead to the formation of an almost continuous tract of water in the middle and lower reaches. This tract will have a total length of 279 versts, and will create conditions favourable for colonisation in an extensive region which has hitherto been an almost waterless desert. By this means will be achieved the lagoon irrigation of an area of 27,400 desyatinas, and irrigation for the raising of valuable crops in gardens, vegetable gardens, etc., for an area of 6,600 desyatinas.

Considering, furthermore, that the whole locality will be irrigated to the extent of 3 versts on either side of the reservoirs, the total area artificially watered will be 170,000 desyatinas.

These works will involve the excavation of 35,000 cubic sazhenes of earth. The scheme embraces plans for pisciculture and fisheries, and also for the construction of fish-leaps.

The plans for the Great Uzen have not yet been completed; they contemplate two embankments in the middle stretches of the river. The first of these will be above the town of Novouzensk, and the second will be near the settlement of Alexandrov Gai. The works will effect lagoon irrigation for an area of 25,000 desyatinas, and artificial watering for the intensive culture of a total area of 7,000 desyatinas.

The flow of water over the weirs must be regulated in such a way that the lower reaches of the river will continue to receive an appreciable quantity of water. We have, however, to remember that the catchment of the Uzen is only 12,600 square versts, and is consequently small in comparison with the general area to be watered by the river. When two great embankments, each 8 sazhenes in height, are built, they will hold back an enormous quantity of water, and in the initial stages this cannot but be attended by a reduced flow into the lower reaches. During the first year after the building of the dams is completed, the lower reaches of the river will probably be short of water. Consequently, for the supply of the lower reaches with water (especially in the case of the land belonging to the settlement of Slomihin) it will be necessary to construct a canal 120 versts in length from the Kushum to the lower part of the Great Uzen. This canal will be fed from the Ural. Furthermore, the canal, annexing the waters of the rivers known as the First, Second, and Third Chizh, will irrigate about 70,000 desyatinas of land.

We have already learned that the Kushum must be regarded as a sometime offshoot of the Ural. It branches off from that river 40 versts below the town of Uralsk, near the settlement of Kushumsk. After a course of about 300 versts through the desert steppe, it debouches into Kamysh and Samarsk Lakes. A few decades ago, the Kushum received plenty of water every springtime when the Ural was in flood, but of late it has been exceptional for the spring freshets to make their way into the Kushum—about once every five or six years. The supply

of water from the Kushum is of the utmost importance to the area in question, for here there are no other sources.

It is proposed to construct a canal, from the Ural leading into the upper part of the Kushum, which will have a length of 17 versts, will be 8 sazhenes wide at the bottom, and will be provided with stony roller sluice-gates. The canal will discharge 11·55 cubic sazhenes of water per second. To provide for the lagoon irrigation of the land adjacent to the Kushum, to the extent of 120,000 desyatinas, and for the filling of the reservoirs, allowing for loss by percolation and evaporation, the canal will [during the season of the spring freshet] discharge on the average 52,000,000 cubic sazhenes of water. This constitutes from 2 to 4 per cent. of the total amount of water flowing down the Ural during the freshet, and its withdrawal will not therefore cause any appreciable diminution in the flow of that river. For the feeding of the canal from the Kushum to the lower reaches of the Great Uzen, the quantity of water will obviously have to be increased by 50 or 100 per cent. To begin with, the scheme contemplates the inauguration of lagoon irrigation for an area of 24,000 desyatinas. The cost of this, allowing for the construction of the canal and of the dams with their flood-gates, works out at 50 gold roubles per desyatina. The estimates show that this expenditure would be recouped at the very outset simply by the increase of the hay crop in the areas subjected to lagoon irrigation. Nor have we mentioned that, thanks to the reservoirs along the banks (and the same thing applies to the reservoirs along the Little and the Great Uzen), flower, fruit, and vegetable gardens (known locally as "plantations") will flourish. For this stretch of 300 versts, the area of such gardens may range from 10,000 to 15,000 desyatinas. As was pointed out above, irrigation for horticultural purposes is already practised in this area to a considerable extent; but a difficulty in the way of such small-scale irrigation is that for each section there must be inaugurated its own motor-driven pumping plant. In the case of these large undertakings, where the length of the reservoirs is measured by tens of versts, it is possible to arrange for collective pumping plants installed upon little vessels which can move from place to place. The plans must include estimates for such installations.

As far as the irrigation works on the Kushum are concerned, we must refer to a peculiar effect which the flow of this river has upon the ground water of the locality.

The Kushum flood waters percolate to a great extent into the sands along the lower reaches of the river, augmenting here the ground water, reducing its salinity over a considerable area to a sufficient degree to render the water suitable for use by live stock. As a result of the construction of the above-described waterworks, this phenomenon will be of annual recurrence.

Certain supplementary undertakings must form part of the general scheme of the Kushum irrigation works. Surveys must be made in the area of 120,000 desyatinas where lagoon irrigation is to be inaugurated. In the case of the canal which is to supply water to the lower reaches of the Great Uzen, surveys will likewise be needed in the areas suitable for irrigation lying along the canal. A few reservoirs must also be constructed beside the canal.

There is really no ground for the doubts that have frequently been expressed regarding the engineering practicability of irrigation works in this locality, and regarding the financial benefits likely to accrue. The local population has had many years' experience, which suffices to show the practical value of irrigating, not only their flower, fruit, and vegetable gardens, but also their ordinary farming lands. Moreover, various technical and agricultural methods are available for dealing with the undue salinity of the soil, should this persist even after irrigation has been effected.

Prospects.

By means of the general scheme of works above described, we shall effect the lagoon irrigation of an area of 172,000 desyatinas; we shall supply water to flower, fruit, and vegetable gardens occupying 25,000 desyatinas; and we shall irrigate, in addition, an area of half a million desyatinas. Assuming that in this locality each farm requires 25 desyatinas of irrigated land (including, in the 25, part of the lagoon-irrigated land and a small part of the irrigated garden land) we see that it will be possible to settle 27,000 families here. Moreover, upon these irrigated lands, the harvest will increase and will become much more stable. The irrigated gardens will provide on the average about 25,000,000 poods of fruit and vegetables. Many years' experience in the use of lagoon irrigation in this locality where the earth is strongly impregnated with salt has shown that there is no ground for uneasiness as to the results. On the contrary, the lagoon method of irrigation washes the upper strata of the soil, dissolving the salts. It therefore improves the soil, for by degrees part of the unfavourable

salt land is made amenable to cultivation. Beyond question, too, in this area, where a considerable part of the dwellers along the Ural and on the lake shores gain their livelihood as fishermen, the building of huge reservoirs, creating tracts of water a hundred versts in length, will be of great advantage to fishery and pisciculture.

In view of the nature of the results to be expected from these projected works, which are essential if agriculture is to flourish in an immense area that is now desert, we must regard the work as a matter of the first importance, instead of looking too anxiously at considerations of expense. It is, however, obvious that the difficulties of procuring what is requisite in the way of tools, machinery, and building materials, are enormous, as far as local resources are concerned. If these schemes are to be speedily inaugurated, the materials that are lacking in Russia must be imported from abroad.

Estimated Cost.

The total cost of the undertaking will be as follows. Considering that on the average it will cost 50 gold roubles for the lagoon irrigation of one desyatina; that it will cost 300 gold roubles for other methods of irrigation per desyatina; and that it will cost 10 roubles per desyatina for embankment works—we find that the whole cost will amount to 21,000,000 gold roubles. The final estimates for the Little Uzen scheme, which is already in train, foresee an expenditure of 1,000,000 gold roubles.

Seeing that most of the work (the construction of embankments, dams, and canals) can be done by unskilled labour, the undertakings can be looked upon as part of ordinary public works. As a beginning and in the near future, work can be undertaken upon the Little Uzen, for the construction of the canal from the Ural to the Kushum, and for building the embankments along that river.

The Order of the Work.

All the schemes that have been reviewed are of primary importance. They must, however, be considered in the following order:

(1) Full details must be worked out for the Great Uzen scheme and for the Kushum, with the canal from that river to the Great Uzen.

(2) The embankments on the Little Uzen and the Kushum; and the canal from the Ural to the Kushum.

(3) The working out of full details concerning the supply of complicated machinery, flood-gates, waste-weirs, and other requirements for hydraulic engineering.

IMPROVEMENT SCHEMES IN THE VOLGA DELTA AND IN THE ALLUVIAL STRIP OF THE VOLGA AND THE AKHTUBA.

CIVIL ENGINEER B. H. SHLEGEL

The Delta and the alluvial Strip.

AMONG the localities in the South East which are destined to play a considerable part in the agricultural life of that area, attention must be given to the delta of the Volga and to the alluvial strip of the Volga and Akhtuba.

A huge stretch of land amounting to 2,000,000 desyatinas, of which 500,000 are now under water, can be rendered fit for cultivation with the aid of simple engineering works. Intensive culture can then be inaugurated, preferably in the form of vegetable gardening.

Lying between arid regions of semi-desert, this alluvium forms a narrow strip running from the head of the Akhtuba to the Caspian Sea, where the delta broadens out at its base to a width of 100 versts. The alluvial strip varies considerably in width. For example, near the town of Tsaritsin it is from 30 to 40 versts wide; but lower down the rivers (to the south of Vladimirovka) it is much narrower, ranging from 10 to 15 versts.

Until a very recent date, in the northern part of the alluvial strip, the inhabitants devoted their energies chiefly to growing fodder (hay), which formed a stable basis for the development of stock-raising along various lines, as the market might dictate; here very little attention was given to the fisheries. In the Volga delta, on the other hand, while the environs of the town of Astrakhan have long been famous for horticulture, the southern part has conditions extremely favourable to the fishing industry.

An Oasis of Horticulture.

During the close of the nineteenth century and the beginning of the twentieth, thanks to the favourable economic circumstances of the region, there was to be noted in the environs of the cities of Astrakhan and Tsaritsin a vigorous blossoming, amid the encircling semi-deserts, of horticultural oases. Consequently, in the alluvial strip, there was an extension of the horticultural area at the expense of the area devoted to hay crops; and

in the delta there was an increase in the horticultural area at the expense of the area where in the springtime the young fish make their appearance.

This extension of horticulture has hitherto been effected in a quite elementary fashion. Each farmer and each settlement has increased the area under fruit and vegetables as has seemed necessary and possible. There has been no sort of regulation, and no aid from elsewhere. Everything has been based upon the personal initiative of the owner. Moreover, the physical conditions are such as to make it extremely difficult for the private owners to instal irrigation plants—such as embankments ranging from 1½ to 2 sazhenes (11 to 14 feet) in height, norias, motors, etc. These circumstances have hindered the development of irrigated crops. In addition, both in the alluvial strip and in the delta, destructive processes are still at work; thanks to this, frequent changes occur in the direction of the main watercourses and the connecting channels; great areas of garden land are often washed away, or where a garden flourished a waste of river mud takes its place.

In this area the temperature remains above freezing point for eight or nine months in the year, so that most of the year is available for land work. The combination of warmth and moisture creates conditions extremely favourable to the growth of vegetation; fruit trees bear abundantly for five seasons in succession; the poplar attains a remarkable thickness within ten years. The nearness of the oil wells facilitates the use of internal combustion motors for irrigation purposes. The produce can be conveyed to the market by cheap and convenient routes.

The extant oases of cultivation in the area, created by the labour of the local population, suffice to show that the proposed improvements will be simple to execute and will be paying propositions; in addition, they illustrate the lines along which the agriculture of the region will have to work.

The deplorable victualling prospects of the South East, as far as the immediate future is concerned (and in view of the fact that it will take many years to re-establish the agriculture of the area), necessitate the creation of great victualling centres from which the farms in course of construction can be supplied with grain. The locality we are now considering can function as such a centre, for it is competent to produce crops totalling more than a hundred million poods per annum.

Through the transformation from extensive culture to intensive, associated here with a superabundance of raw materials, there will naturally be brought about a corresponding development of industry.

At the conference of representatives of the local administrations held at Astrakhan in 1921, it was made perfectly clear that the interests of the fishing industry and the interests of agriculture could be satisfactorily harmonised provided that the building of dikes in the delta and the alluvial strip, and the subsequent exploitation of the embanked areas, were carried out in accordance with a carefully designed plan.

Of late, owing to the scarcity of grain in the neighbourhood of Astrakhan, the fishing population has taken to agriculture. The area under cultivation has increased to 100,000 desyatinas, and there seems every prospect of a further extension.

The soil, the climate, and the economic conditions of the Volga delta and the alluvial strip of the Volga and the Akhtuba combine to render the area a favourable one for exploitation, either by concessionaries under special conditions, or else by a Russian colonisation scheme of the ordinary kind.

Surveys.

In either case, preliminary investigations will be requisite for three years, taking the form of land surveys, hydro-geological researches, studies of the soil, a survey of the course of the Volga and its offshoots, and the establishment of a number of experimental stations. The study of the lower reaches of the Volga, together with that of the extensive agricultural area of the alluvial strip, cannot be carried out within a brief space of time. All the more is this true inasmuch as the problems have to be solved in a concrete fashion ; and inasmuch as every mistake will have undesirable consequences, will reduce the agricultural yield of the land, and will involve additional expenditure in the future.

The program of the surveys has already been drawn up in general outline, and in drafting it the best intelligences of the centre and of the locality have been at work. Reckoning in pre-war terms, the preliminary investigations and the inauguration of the scheme will require about 1,500,000 gold roubles. In view of the comparative scantiness of the material resources, about 250,000,000 gold roubles will be needed for the actual constructive works and the associated improvements.

In this locality the grain harvest ranges from 150 poods

to 250 poods per desyatina. Assuming that the culture will be of the extensive type, the total grain crop will amount to more than 100,000,000 poods, and, reckoning at the pre-war standard, this would be worth about 30,000,000 gold roubles.

In addition to the cost of the improvement schemes, funds will have to be provided for the erection of dwelling houses and farm buildings, for the supply of live stock and farming implements, and for the inauguration of industrial life. The expenditure under these heads will amount to several hundred million gold roubles.

The local work of dike building can be set in hand immediately, utilising for the purpose the members of the local population to the number of ten or fifteen thousand. Not only will this give employment to the inhabitants upon work of communal importance, but in addition it will increase the area under cultivation by several thousand desyatinas, and thereby next year's harvest will be augmented by several hundred thousand poods of corn.

To sum up, we draw the following concrete conclusions. (1) It is essential, without delay, to undertake a comprehensive survey of the whole area. (2) Dike building must be promptly initiated upon a considerable scale, with the aid of local labour. (3) Work must be speedily set afoot for the establishment of combined concessionary enterprises in this region. These must take the form of general improvement schemes, the improvement of communications, colonisation, the founding of industrial undertakings, and the exploitation of the fisheries.

ELECTRIFICATION IN THE SOUTH EAST [1]

CIVIL ENGINEER A. V. VINOGRADOFF

Preliminary Considerations.

THE choice of this or that number of local stations, of the power of the plant in each case, and of the area of distribution, depends for each locality upon the association of a whole series of factors. First of all we have to consider, not merely the kind and the amount of energy needed in the given place at the given time, but in addition (by way of forecast) the growth of the demand which will ensue upon the development of agriculture. Furthermore, among the factors of a purely technical character, the most careful attention must be paid to all the available sources of energy in the locality.

The area with which we are specially concerned is, by its economic characteristics, sufficiently defined as the granary of Central Russia; for the surplus of grain produced in the South East will certainly be exported, and will thus form one of the staples of our foreign trade.

A general tendency towards the eastward transference of the centre of gravity of tillage and stock-raising has already been observable in Russia. Should conditions prove favourable to the industrial development of the area generally, and should the omens be propitious for an adequate growth of the manufacture of agricultural machinery and other implements, we may confidently anticipate a notable intensification of husbandry and a rapid development of the branches of industry intimately connected with tillage and with stock-raising. These changes will yet further increase the importance of the South East as a source of food supply for Central industrial Russia.

If we study the agricultural life of this area in the past, our attention is drawn to the extensive variations in the harvests, and we perceive that these fluctuations have been mainly dependent on climatic conditions. The inade-

[1] In drafting this outline, the author has had at his disposal the extensive materials collected by the State Commission for Electrification in Russia. He has also been assisted by the works of Professor K. A. Krug and Civil Engineer Regirer.

quacy of the rainfall, in conjunction with the extreme brevity of the period during which in each year the rainfall occurs, has been the cause of the prolonged droughts from which the area has suffered, periodically reducing it to a hungry desert, and giving to its agriculture an extremely unstable character.

In this respect, ameliorative measures, such as would render it possible to practise irrigation whenever necessary, would render immense services to the whole area, both by way of increasing the ordinary harvest, and by way of diminishing the likelihood of a failure of the crops. The improvement schemes embrace an area of land amounting to 883,000 desyatinas, and involve earthworks having a cubic capacity of 7,000,000 cubic sazhenes.

The Need for Mechanical Energy.

The improvement schemes now being considered will have to be carried out under exceedingly rough conditions, and are therefore unlikely to attract a sufficient supply of voluntary labour. Hence the installation of mechanical power plants on the large scale will be necessary, all the more since about 80 per cent. of the work will be excavation and embankment work. The energy required for exploiting this area will range from 0·16 to 0·3 of a horse-power per desyatina, so that we must provide for a total horse-power of 135,000.

The widespread application of electrical energy to husbandry will render possible a notable increase in the productivity of the soil, and will indirectly contribute to the general advance of agriculture, including cattle-raising, sheep-farming, and other rural occupations closely connected with the tilling of the soil.

Furthermore we must note that whereas formerly, under more or less normal conditions, the application of mechanical power to improvement schemes and to agriculture appeared generally desirable, now, as far as the devastated area is concerned, this seems to be the only possible way of reviving agriculture, for the disaster is so comprehensive that nothing short of the most radical measures can save the situation. Unless there is a complete reform of agriculture, based upon a careful study of the weak points, it will be impossible to insure against the recurrence of similar catastrophes. Such a study points to electrification as the only suitable method of enabling us to carry through the gigantic task of restoring the economic life of the devastated area. All other ways, all primitive methods, will only protract the process, and will culminate in installing home industry.

In calculating the amount of electrical energy needed for agricultural work, it is necessary to bear in mind, first, that when the electromotors have been installed they will work with a load of not less than 60 per cent. of their marginal capacity, and, secondly, that when agricultural work is rightly distributed it will be possible to reduce the total demand for power at any one time. Consequently, in deciding the strength of the power plant at a central station, the possible total demand for power in agriculture at any one time is not a matter of decisive importance.

The general Need for electrical Energy in Industry.

The industrial demand for electrical energy requires far closer attention. In general, we can foresee and arrange for an extensive eastward transference of Russian industry. In association therewith, we may anticipate a vigorous development of industry in the South East, in view of the geographical conditions of the area, its wealth of raw materials, and its possibilities as regards markets and transport facilities. It is, however, extremely difficult to make any precise forecasts of this industrial development. Nevertheless we may assume that, as soon as the local power plants are in working order, the industrial life of the locality will receive a vigorous impetus. The very fact of the building of the power stations, guaranteeing a cheap and satisfactory supply of electrical energy, will stimulate the development of extant branches of industry, and will promote the inauguration of new branches.

At the present time the development of industry in the area does not as a whole bulk very largely. Nevertheless, in certain localities, and especially along the waterways, there are branches of industry which have attained general in addition to local importance.

Among these, the premier place is occupied by the elaboration of food-stuffs, which absorbs 40 per cent. of the whole energy devoted to industrial undertakings. In view of the great future to be expected for agriculture in this part of the world, we may confidently anticipate a notable development of these enterprises. Next come the metal industries, which absorb 15 per cent. of the energy devoted to industry as a whole. Here likewise the prospects of future development are exceedingly bright, thanks to the favourable position of the area as concerns transport, raw materials, and fuel. The timber trade will be of less importance, although for this, too, the outlook is sufficiently favourable. As far as other branches of

industry are concerned, the probable development of the manufacture of artificial manures, and to some extent also the manufacture of explosives, deserve mention. In the State electrification scheme, the need for power is reckoned at 132,000 kilowatts, with an annual output of 340,000,000 kilowatt-hours.

The technical Conditions of Electrification.

We now pass to the consideration of technical factors. In view of the lack of any notable amount of water-power in this part of Russia, the supply of electrical energy must be exclusively derived from local power stations supplied with fuel. Owing to the increasing deforestation, and owing to the immense importance of forests as regulators of humidity, it will be essential to refrain from the use of wood as fuel, except in small quantities which may reach the area in the form of rafts coming from the higher reaches of the Volga.

As far as peat is concerned, the supplies of this fuel progressively diminish as we pass from north to south. There are more than 30,000 desyatinas of peat, and the amount of burnable peat obtainable amounts to 4,000,000,000 poods. Nevertheless, the peat deposits are so unequally distributed that the widespread utilisation of peat as fuel is out of the question.

Shale as Fuel.

In the middle and lower parts of the Volga basin, however, we find a new variety of fuel, bituminous shale, which plays a very important part among the fuel potentialities of the area. As far as we know at present, the Simbirsk beds contain 16,000,000,000 poods, and the Sizran beds 9,000,000,000 poods, of bituminous shale. These shales vary considerably in quality, but on the average they contain 20 per cent. of moisture and 50 per cent. of ash, and yield an effective heat of 2,000 calories.

The possibility of utilising bituminous shale as a means of generating steam-power is no longer open to doubt. Last winter, Civil Engineer Regirer constructed the first shale furnace ever used in this country, and it has now been working successfully for more than six months.

Experimental furnaces have been built, and, in these, results have been secured which supply initial materials, first for the valuation of shales as fuel, and secondly for the planning of power stations in which shale will be the source of energy.

It may be regarded as definitely proved that shale is a poor fuel, notably inferior in heating capacity to the fuels that have hitherto been more widely known, such as wood, peat, and coal. Nevertheless, bituminous shale is com-

bustible, though with a comparatively low coefficient of heat production.

Shale is sharply distinguished from other fuels by the enormous weight and bulk of the ash needing removal. The amount of ash is five times as great as that resulting from the combustion of peat and of the coals containing the highest percentage of ash.

For these reasons, shale can only be used as fuel in places near the mines and also not too far away from the locality where the electrical power is to be employed. Since it is a low-grade fuel, the most serviceable way of utilising it would seem to be in regional electrical power stations. Thus the difficulty of transport is overcome. Instead, we transmit the electrical energy which is produced by burning the shale.

The Power Stations and their Distribution.

The State electrification scheme provides for two centres. The first of these is to be in the Kazan area, with a power of 40,000 kilowatts. The second is to be in the Sizran area, with a power of 50,000 kilowatts. Assuming that to begin with the stations will have only about half this power, and allowing for the plant requisite for the working of the shale mines, the cost of these two stations with their cables for distributing the electrical energy will range from 16,000,000 to 17,000,000 roubles.

Owing to the entire absence of forests in the central and southern parts of the area, they must be supplied with wood brought down from the higher reaches of the Volga in rafts. Saratov and Tsaritsin will have to become centres for the transport and cutting up of timber. Thus it will be possible to establish in these localities electric power stations dependent upon wood fuel. The supply of fuel from this source is a matter of especial importance to Tsaritsin, since the town is a forwarding centre for heavy goods destined for the Don basin.

In the southern part of the area, natural gases claim a considerable share of attention. They emerge through fissures, from gaseous strata under a pressure ranging up to 3 atmospheres. Of especial practical interest are the natural gases of Kamenni Yar, near Tsaritsin, those of Astrakhan, and those of Novouzensk county in Samara province. In the last-named has been planned a first station (or rather, a whole series of gas plants supplied with gas from fissures in the ground) with a capacity of about 50,000 kilowatts.

The prospects of utilising the natural gases of Cherni Yar and Kamenni Yar are likewise extremely favourable.

The natural gas resources of these two places have not as yet been adequately studied, and a searching local investigation is therefore a matter of the first importance. Power stations supplied with energy "gratuitously," by the use of natural gas, can be run at such an exceedingly low cost, that it would be well worth while to make researches without thinking too much about the initial outlay.

Wind-Power.

Wind-power is even cheaper, and can therefore be used more extensively in this area, where the winds attain a notable velocity. The only obstacle to the use of wind-driven power plants, or rather to their employment on a large scale, is the inconstancy of the winds, which necessitates the use of various kinds of regulating appliances.

For the adaptation of wind-power to the generation of electricity, there exist to-day a number of admirable devices. Mostly, indeed, these were originally invented, not for the use of wind-power, but for similar inconstant motors, where an electrical machine has to be able to adapt itself to rapid changes in motive force. The question of utilising wind-power for an electric plant has not received so much attention as the question of using water-power of low intensity. In the latter case, as is well known, the plan is for the use of asynchronous generators, working in conjunction with a system of electric transformers. Experiments with such appliances in America and Germany have given admirable results. In this way, with the aid, that is to say, of asynchronous generators and suitable transformers, it will be possible to combine a wind-driven electric power plant with a system of regional sub-stations.

As far as concerns the storage of the energy derived from wind-power, this can be combined in an interesting way with irrigation works. Reservoirs of a considerable size can serve as ready-made accumulators of wind-power. Water is pumped up into the reservoirs, and is liberated as required. In its downward flow it can be made to restore the energy employed in pumping it up. Unfortunately, however, a considerable amount of preliminary investigation will be requisite before apparatus of this character can be successfully installed.

From the outlook of the State authority the question of the expediency of electrification in the South East is so complex that it cannot be exhaustively discussed in the present brief sketch.

Turning to consider the prospects of a general revival,

we have already said that such a revival will inevitably result from the eastward transference of industry, agriculture, and trade. In this respect, the area we are considering has, owing to its geographical situation, a great future.

One of the primary aims of those who guide the economic destinies of Russia must be the promotion of the development of agriculture in the South East by the introduction of improved methods of husbandry and in various other ways. Another primary aim must be the furtherance of the transfer to this area of those branches of industry whose life in the North and the Centre is quite artificial.

Foreseeing these developments, recognising them to be both inevitable and expedient, the State authority must create conditions favourable to their occurrence. One of these conditions is electrification.

The impoverishment of Russia and the lack of material resources render far-reaching constructive works impossible at this juncture, however urgently they may be needed; nor is there any prospect that we shall be able to buy what we want in the near future. Nevertheless, considering the question from this point of view, we can affirm that, however feeble the development of industry in the South East as compared with Central Russia, the absolute size of the South East is such that almost from the very outset this area will be able to make a profitable use of electric power stations.

ELECTRIC POWER STATIONS IN THE VOLGA VALLEY

PROFESSOR K. A. KRUG

Sizran Station.

THERE are shale deposits at Undory near Simbirsk and at Kashpir near Sizran. Of these, the more interesting as concerns electrification is the Kashpir deposit, owing to the fuller development of productive industry in this region. The area which could be supplied with electrical power from Kashpir, extends to Simbirsk on the north, to the Volga in the south, to Penza in the west, and to Samara in the east.

Of the first importance would be a railway line to Samara, which would obviously be a paying affair from the very outset. The electric power plant for the area above defined will provide for the supply of the following amounts of energy: to the town of Samara, 17,156 h.p.; to the village of Ivashenk, 7,301 h.p.; to the village of Ekaterinovka, 510 h.p.; to the town of Sizran, 2,996 h.p.; and to Batraki, 548 h.p. Adding the amount required for a number of minor places and also what will be needed for working the shale mines, the total power of the plant will have to be about 30,000 h.p.

The industries consist of a number of large mills, chemical works, a large pipe factory, and various medium-sized and small undertakings engaged in different branches of production.

Bearing in mind that some of these plants would be unsuitable for electrification (the chemical works, for instance, owing to the high working cost of steam), we may reckon with great probability that 15,000 h.p. would suffice for the electrification of the industries in question. We have also to consider the demands of agriculture, the supply of power for the improvement schemes, the increasing demand for electricity in the towns and villages, and the prospective development of industry in this region. Taking it all in all, a preliminary installation of a plant with a power of 20,000 kilowatts cannot be regarded as excessive.

As to the possibility of using shale as fuel in the furnaces of the engine house, the matter is no longer in doubt. Last winter, Civil Engineer Regirer planned and built the first Russian furnace for burning bituminous shale, and this has now been working satisfactorily for six months. Experimental furnaces have been constructed, and, in these, results have been secured which supply initial materials for the valuation of shales as fuel and for the planning of power stations in which shale will be the source of energy.

The fundamental requisite for the burning of shale in large plants is that the transport facilities to the engine houses should be on an extremely generous scale. Hence the initial cost of an electric power house where shale is burned will be higher than if any other fuel is used. It works out at 275 roubles per kilowatt of the capacity of the plant. Thus the cost of the station we are contemplating will be not less than 5,500,000 gold roubles. The cost of the distributing plant, including high-voltage cables (capable of carrying 115,300 volts) 110 versts in length, the necessary transformers, and the various local distributive lines, will be about 3,000,000 roubles.

As to cost of the mining plant at the shale mines, this is not an affair which directly concerns the estimates for the power station. If matters are rightly organised, the exploitation of the shale beds, and the expenditure requisite for this, will proceed independently of the question whether the power station is or is not built. Nevertheless, the shale mines can be worked more cheaply if the power plant is built and if the mines are supplied therefrom with electricity.

Speaking generally, the plant required for working the shale mines will consist of ventilating appliances, pumps and conduits, trucks and rails, cages and other elevating apparatus, loading appliances, etc., etc. The initial cost may be estimated at 500,000 roubles.

The total estimates, therefore, range from 9,000,000 to 9,500,000 gold roubles.

Saratov Station.

Side by side with the Kashpir station we must consider the question of constructing at Saratov the station (to be supplied with shale from Kashpir) which has been mooted in connection with the State electrification scheme. Saratov is one of the chief centres in the Volga valley. A place where industry is already developed to a considerable extent, it has a number of large and medium-sized metal works (New Etna, Sotrudnik, the half-finished Stel, and

others), many mills, oil presses, tobacco factories, etc. Within the Saratov area there is not as yet any large electric power station competent to supply the whole district. The town Diesel-engine station has a horse-power of 3,200. It is hopelessly overworked in its attempts to satisfy the demand for electricity, for this demand has long since outstripped the capacity of the plant. The existing development of industry at Saratov, and the prospects of yet greater development, provide conditions favourable to the idea of building an electric power station here, and indeed make it essential.

The horse-power of the machinery now employed in this locality is as follows. Town of Saratov, 16,000; Pokrovsk (near Saratov, on the left bank of the Volga), 1,043; village of Shakhmatovk (Saratov Manufacturing Works, 20 versts from Saratov), 1,375. Adding the requirements of the small plants in the vicinity of Saratov, we reach a total of about 20,000 horse-power. In view of the fact that the industrial development of Saratov will undoubtedly be extensive, and considering that in this area (which, thanks to its geographical situation, must function as the granary of Russia) electricity will be of the utmost service to agriculture, we are well within the mark in suggesting a power plant with a capacity of 20,000 kilowatts.

The shale required as fuel will be brought by water. Consequently we must arrange for the provision of suitable transport appliances. Ample storage accommodation must be supplied close to the power station. Indeed, since the conveyance will only be possible during the months when the waterways are navigable, arrangements must be made in Saratov for the storage of shale amounting to 75 per cent. of the annual consumption.

We may therefore estimate the cost of the station at about 6,000,000 roubles.

The cost of the transmitting plant can be put at a very low figure, for, in addition to what will be required for the town and its environs, all that will be needed will be one short line to the Saratov Manufacturing Works in the village of Shakhmatovk. There will, therefore, be no need for high voltage cables. The cost of the transmitting plant may, then, be estimated at 1,500,000 roubles. As regards the cost of the installation at the shale mines, see above.

Adding up the foregoing amounts, we obtain a total figure of 7,500,000 to 8,000,000 gold roubles.

The Svyaga hydro-electric Station.

The Svyaga runs past Simbirsk at a distance of about $2\frac{1}{2}$ versts from the Volga. The extreme difference of level between the Svyaga and the Volga is about 23 sazhenes (160 feet). The minimal discharge averages half a cubic sazhene per second. This provides a minimal power of about 1,500 kilowatts.

By the construction of dams and the regularisation of the storage of water, provision can be made for an average discharge ranging from 1 to 1·5 cubic sazhenes per second. This would give an average power ranging from 3,000 to 4,000 kilowatts.

The earthworks required would be about 30,000 cubic sazhenes, and the cost can be estimated at 3,000,000 gold roubles.

It is necessary to remember that it would be inexpedient to utilise all the water of the Svyaga for the hydro-electric plant, seeing that on the banks of the stream there are large farms and several villages.

VEGETABLE GARDENING AND ITS POSSIBILITIES

PROFESSOR P. G. SHITT

WHEN considering the problem of the restoration of agriculture in the South East, we must not fail to take vegetable gardening into account, for this branch of husbandry is of serious moment, not only for the rural population, but for the urban population as well. The present brief essay aims at estimating the area which should be put under vegetables, etc., in the South East, and at indicating how much live stock, what implements, how much seed, and how much manure, will be needed for the supply of the whole vegetable-gardening area. The figures thus arrived at must serve as preliminaries to an estimate of the possible yield of market gardens in the suburban and in the rural districts of the South East.

Areas.

At the present time we lack information concerning the area used for vegetable gardening in the provinces of the South East. All our calculations, therefore, relating to areas must be made upon the basis of the food requirements of the consumer. The average amount of vegetable-gardening land required for one consumer may be estimated at 60 square sazhenes. In the case of suburban vegetable gardens this estimate must be doubled, for the following reasons. First of all, the estimate of 60 square sazhenes per consumer relates to field land, and in the suburbs we must add not less than 25 per cent. for roads and paths. Secondly, in the suburbs, 25 per cent. of the land can be reckoned unfavourable for vegetable gardening. Thirdly, we must set aside a reserve of land for the near future, having in view the natural growth of the town and the influx of population from the rural districts; this amounts to 50 per cent. Thus, as far as suburban vegetable gardening is concerned, the area of land required per consumer must be estimated at 120 square sazhenes.

Suburban Vegetable Gardens.

According to the reports of 1920, in the provinces suffering from failure of the crops during the current year, namely, Astrakhan, Tsaritsin, Marxstadt, Saratov, Samara, Orenburg, Ufa, Simbirsk, Kazan, Perm, Turgai, Kalmucks,

Bukeëvsks, Bashkirs, and Vyatka, the urban population numbered 2,502,116. It is possible that this figure is somewhat too high, but Uralsk (for which the reports of 1920 gave no returns) was not included in the foregoing list of provinces, and we may therefore consider that the total urban population of the area with which we are concerned approximates to the number above stated. The data of the last few years show that, in the urban settlements, vegetable gardens of the allotment type predominate, forming 60 per cent. of the whole. The remaining 40 per cent. consists of vegetable gardens producing for the market.

Rural Vegetable Gardens.

In the countryside, the chief vegetable grown for the food of the peasants is the potato, whose qualities enable it to act as a substitute for bread and also to serve as fodder for live stock. Other vegetables, those for which intensive culture is requisite, are a difficult matter for the impoverished peasant farming of the South East, and can therefore only be regarded as supplementary. Consequently, the amount of vegetable-garden land in use by the rural population is on the average only 10 square sazhenes per consumer.

For Urban Vegetable Gardens.

Area Needed.

Urban Population of the South East	2,502,166.
Vegetable-Garden Area required per Consumer	120 sq. sazhenes.
Required for the whole urban Population, in round Figures . .	125,000 desyatinas.

For Rural Vegetable Gardens.

Rural Population in round Figures	20,000,000.
Vegetable-Garden Area required per Consumer	10 sq. sazhenes.
Required for the whole rural Population, in round Figures . .	84,000 desyatinas.

Forty poods of potatoes per annum must be regarded as a hunger ration, and this quantity will hardly suffice unless the percentage of damaged and unusable potatoes is minimal. Allowing for the potatoes that perish when stored and for the wastage in use, and remembering also that in dry years, when the harvest is poor, potatoes are very small, we have to allow 75 poods per consumer per

annum. Reckoning upon a crop of 600 poods per desyatina, it is impossible to provide a sufficiency for more than eight persons from one desyatina. According to this calculation, the area needed for the potato crop amounts to 2,500,000 desyatinas, and in the general rotation of the crops (rye, wheat, etc.) potatoes will be planted in every fifth field.

Live Stock and Farming Implements.

In calculating the requirements of the vegetable farms of the South East as regards live stock and farming implements, we shall base our calculations upon a 50-desyatina farm (since this is of a suitable size for a soviet farm), being guided by the results of four years' experience in the tiny suburban vegetable gardens of Moscow. For the details upon which the calculation is based, the writer is indebted to Professor V. I. Edelshtein. Prices are reckoned in gold roubles.

Requirements for Stocking Urban Soviet Farms.

LIVE STOCK.	For one Soviet Farm of 50 Desyatinas.	For 1,000 50-Desyatina Soviet Farms.	For 75,000 Desyatinas of Vegetable Garden.	Cost per Animal.	Total Cost.
Horses	22	22,000	33,000	100 roubles	5,500,000 roubles
Pigs	4	4,000	6,000	10 ,,	100,000 ,,
					5,600,000 roubles.

FARMING IMPLEMENTS.	For one Soviet Farm of 50 Desyatinas.	For 1,000 Farms.	For 75,000 Desyatinas of Vegetable Garden.	Totals.	Cost per Implement in Roubles.	Total Cost in Roubles.
Farm Carts or Two-Horse Wagons	10	10,000	15,000	25,000	60	1,500,000
One-Horse Sleds	20	20,000	30,000	50,000	12	600,000
Ploughs (Sack)	8	8,000	12,000	20,000	27	540,000
Iron Harrows	4	4,000	6,000	10,000	25	250,000
Rondals	1	1,000	1,500	2,500	100	250,000
Horse Drills	1	1,000	1,500	2,500	150	375,000
Other Drills	2	2,000	3,000	5,000	20	100,000
Cultivators	4	4,000	6,000	10,000	25	250,000
Ridging Ploughs	2	2,000	3,000	5,000	15	75,000
Hand Barrows	8	8,000	12,000	20,000	14	280,000
Spades and Forks	100	100,000	150,000	250,000	3·50	875,000
Rakes	20	20,000	30,000	50,000	1·50	75,000
Hoes	100	100,000	150,000	250,000	1	250,000
Trowels	50	50,000	75,000	125,000	0·50	62,500
Pitchforks	50	50,000	75,000	125,000	1	125,000
Watering Cans	30	30,000	45,000	75,000	3	225,000
Pails	20	20,000	30,000	50,000	1·50	75,000
Scythes	10	10,000	15,000	25,000	2	50,000
Sprayers	2	2,000	3,000	5,000	20	100,000
Harness Sets	22	22,000	33,000	55,000	30	1,650,000
Axes	10	10,000	15,000	25,000	1·50	37,500
Cross-cut Saws	5	5,000	7,500	12,500	3	37,500
Hammers	10	10,000	15,000	25,000	1	25,000
Padlocks	20	20,000	30,000	50,000	1	50,000
Sets of Carpenter's Tools	1	1,000	1,500	2,500	75	187,500
Casks and Butts	3	5,000	7,500	12,500	50	62,500
Tubs	15	15,000	22,000	37,000	10	370,000
Forcing-Bed Frames	500	500,000	750,000	1,250,000	3·50	4,375,000
Glass Frames	30	50,000	75,000	125,000	15	1,875,000
Weighing Machines	1	1,000	1,500	2,500	110	275,000
Smithy Sets	$\frac{1}{5}$	200	300	500	150	75,000
						15,077,500

FODDER.	For one Soviet Farm of 50 Desyatinas, in Poods.	For 1,000 Farms, in Poods.	For 75,000 Desyatinas of Vegetable Garden, in Poods.	Totals in Poods.	Cost per Pood, in Roubles.	Total Cost, in Roubles.
Hay (200 poods per horse) .	4,400	4,400,000	6,600,000	11,000,000	0·30	3,300,000
Oats (125 poods per horse) .	2,755	2,750,000	3,625,000	6,375,000	0·90	5,737,500
						9,037,500
MANURES.						
Nitrates .	150	150,000	225,000	375,000	3	1,125,000
Hyperphosphates .	1,000	1,000,000	1,500,000	2,500,000	0·75	1,875,000
Dung .	50,000	50,000,000	75,000,000	125,000,000	0·02	2,500,000
						5,500,000

WATER SUPPLY.	No. of Outfits.	No. of Outfits.	No. of Outfits.	Total of Outfits.	Cost per Outfit in Roubles.	Total Cost in Roubles.
Diaphragms Pumps .	1	1,000	1,500	2,500	5,000	12,500,000
Wells and Fitments.	1	1,000	1,500	2,500		

VARIOUS MATERIALS.	Cost per Farm, in Roubles.	Cost per 1,000 Farms, in Roubles.	Cost per 75,000 Desyatinas, in Roubles.	Total Cost, in Roubles.	Cost per Outfit in Roubles.	Total Cost in Roubles.
Ropes . Nails . Building Materials. Glass . Putty. Kerosene . Lubricants . Matting . Baskets .	1,500	1,500,000	2,250,000	3,750,000	—	3,750,000

MANUAL LABOUR.	No. of Days.	No. of Days.	No. of Days.	Total Days.	Cost per Day.	
Working days .	15,000	15,000,000	22,500,000	37,500,000	1 Rouble	37,500,000

Means for the Struggle with noxious Agents.

	For one Soviet Farm of 50 Desyatinas.	For 1,000 Farms.	For 75,000 Desyatinas of Vegetable Garden.	Totals.		Total Cost in Roubles.
Paris Green .						
Green Soap .						
Tobacco Spray						

Seed.

	Percentage of Vegetable Garden sown with each Vegetable.	No. of Desyatinas.	Weight of Seed per Desyatina.	Weight of Seed for whole Area.	Cost of Seed per Pood.	Total Cost in Roubles.
	Suburban Vegetable Gardens. Total Area 125,000 Desyatinas, in Roubles.					
Potatoes .	50	62,500	100 Poods	6,250,000	0·30	1,875,000
Cabbages .	25	31,250	1 Pound	781	80	62,480
Beetroots .	10	12,500	1½ Poods	18,750	40	750,000
Carrots . .	5	6,250	15 Pounds	2,344	40	93,760
Cucumbers .	5	6,250	20 ,,	3,125	40	125,000
Onions, etc. .	5	6,250	30 Poods	187,500	3	562,500
						3,468,740
	Rural Vegetable Gardens. Potato Fields 2,500,000 Desyatinas; other Vegetables 84,000 Desyatinas.					
Potatoes .	—	2,500,000	120 Poods	300,000,000	80 Roubles	100,000
Cabbages .	60	50,400	1 Pound	1,260	40 ,,	336,000
Cucumbers .	20	16,800	20 ,,	8,400	40 ,,	504,000
Beetroots .	10	8,400	1½ Poods	12,600	40 ,,	126,000
Carrots, etc. .	10	8,400	15 Pounds	3,050	40 ,,	
						1,066,800
						+3,468,740
						4,535,540

Supplementary Stock of Implements for the rural Areas.

	For 1 Desyatina.	For 84,000 Desyatinas of rural Vegetable Gardens.	Cost per Implement.	Total Cost, in Roubles.
Spades .	24	2,016,000	3 Roubles 50 Kopecks	7,056,000
Rakes . .	6	504,000	1 ,, 50 ,,	756,000
Hoes . .	24	2,016,000	1 ,,	2,016,000
				9,828,000

Probable Harvest for the Percentage Sowings stated.

	Town.			Country.			
	Percentage of Land Sown.	Per Desyatina, in Poods.	For 125,000 Desyatinas of Vegetable Gardens, in Poods.	Percentage of Land Sown.	Per Desyatina, in Poods.	For 84,000 Desyatinas of Vegetable Gardens, in Poods.	Potato Fields 2,500,000 Desyatinas. Total Crops, in Poods.
Potatoes .	50	1,000	62,500,000	—	600	—	1,500,000,000
Cabbages .	25	2,000	62,500,000	60	2,000	108,000,000	
Beetroots .	10	1,000	12,500,000	10	1,000	8,400,000	
Carrots .	5	800	5,000,000	10	800	6,720,000	
Cucumbers .	5	600	3,750,000	20	600	10,800,000	
Onions, etc.	5	400	2,500,000				

Estimates of the Cost of inaugurating one Vegetable Soviet Farm of 50 Desyatinas.

(1) Seed	1,400 Roubles.
(2) Farming Implements .	6,500 ,,
(3) Live Stock . . .	2,240 ,,
(4) Fodder	3,570 ,,
(5) Manures	2,200 ,,
(6) Various Materials . .	1,500 ,,
(7) Manual Labour . .	15,000 ,,
(8) Management . . .	7,500 ,,
(9) Building	15,000 ,,
(10) Water Supply . . .	5,000 ,,
	59,910 ,,

Returns.

Potatoes . . .	25,000 Poods.
Cabbages . . .	25,000 ,,
Beetroots . . .	5,000 ,,
Carrots	2,000 ,,
Cucumbers . . .	1,500 ,,
Onions	1,000 ,,
	59,000 Poods at 1 Rouble per Pood = 59,000 Roubles.

The calculation of the areas allotted to the various crops is based upon the usual percentage of the areas sown with these crops, in the suburban and the rural districts respectively.

Percentage of Land Sown.

	In suburban Areas.	In rural Areas.
Potatoes . . .	50	—
Cabbages . . .	25	60
Beetroots . . .	10	10
Carrots	5	10
Cucumbers . . .	5	20
Onions, etc. . . .	5	—

Probable Yield of the Vegetable Gardens.

	In suburban Areas.	In rural Areas.
Potatoes . . .	1,000	600
Cabbages . . .	2,000	2,000
Beetroots . . .	1,000	1,000
Carrots	800	800
Cucumbers . . .	600	600
Onions, etc. . . .	400	—

The estimates for live stock and farming implements, manual labour, materials, etc., have been given only for the suburban vegetable gardens. For the rural vegetable gardens, the estimates relate only to sowings, excluding potatoes. We have to remember that: first, the transport of vast quantities of seed potatoes would be impossible at the present time; secondly, the vegetable-garden area of the countryside is to a large extent wasted by being broken up into tiny plots (10 square sazhenes per person); thirdly, the peasants already have a stock of implements for their farms, and it will merely be requisite to provide a supplementary outfit in the way of rakes, spades, and hoes.

AGRICULTURAL MACHINERY REQUIRED.

PROFESSOR V. G. GAN.

Ploughs.

THE term of service of a plough is generally reckoned at ten years.

For the ten-year period 1906–16 the number of ploughs manufactured in Russia and imported from abroad was about 8,300,000 in all. This number, therefore, would represent the actual number of ploughs fit for work in Russia in the year 1916. At that date, the amount of land under the plough in Russia was about 100,000,000 desyatinas.

Since there are no data as to the local distribution of ploughs throughout Russia, we have to assume a uniform general distribution, and that the eleven hunger-stricken provinces have the same proportion of ploughs as the rest of the country. Even though we may suppose that there must be local differences (so that the numerical distribution of the ploughs will vary a little from place to place), when we are dealing with very large areas and very great numbers of ploughs, these differences cannot be considerable.

If we base our estimate as to the actual number of ploughs in certain localities in the year 1916 upon the average amount of land worked by one plough, we find, according to the reports of the year 1916, that we obtain the following data for the hunger-stricken provinces:

Province.	Area Sown in Desyatinas.	Number of Farms.	Approximate Number of Ploughs.
Samara .	4,098,000	512,804	340,000
Saratov .	2,489,000	435,076	208,000
Astrakhan .	730,000	198,492	61,000
Uralsk .	279,670	43,275	23,000
Turgai .	1,013,000	140,992	90,000
Kazan .	1,634,000	445,888	135,000
Simbirsk .	1,346,000	305,513	112,000
Ufa . .	2,446,000	500,543	204,000
Orenburg .	2,291,000	344,592	190,000
Vyatka .	3,003,000	593,561	250,000
Stavropol .	2,092,000	178,213	175,000
	21,421,670	3,698,949	1,788,000

The supply of ploughs began to fall off at the beginning of the war. During the years 1916–1921 inclusive, the supply of new ploughs was reduced to the inadequate amount of 900,000 ploughs for the six years. The average supply was 150,000 ploughs per annum, this being only 20 per cent. of the normal yearly supply of ploughs, of the amount which is essential if the stock of ploughs in Russia is to be maintained at the 1916 level (assuming that the supply for the years 1916–1921 ought to have been the same as that for the years 1906–1911). During the last five years, the supply of ploughs for the whole of Russia has fallen short by the amount of 3,400,000 ploughs. In other words, the stock of ploughs in the country is now 40 per cent. less than the stock at the beginning of the year 1916.

In conformity with these suppositions, we may calculate that in the eleven hunger-stricken provinces the shortage of ploughs at the present date is as follows :

Province.	Number of Ploughs.
Samara	136,000
Saratov	83,000
Astrakhan . . .	24,000
Uralsk	9,000
Turgai	36,000
Kazan	54,000
Simbirsk . . .	45,000
Ufa	82,000
Orenburg . . .	76,000
Vyatka	100,000
Stavropol . . .	70,000
Total . . .	715,000

As regards type of ploughs and efficiency of ploughs, the prevailing need is everywhere the same, if we exclude Vyatka province, and parts of Kazan and Simbirsk provinces. Any inequalities in respect of the distribution among the provinces can be ascertained when fuller and more accurate details have been secured by the local councils of the People's Commissariat for Agriculture.

In this matter of type and efficiency the requirements for certain kinds of ploughs are as follows:

	No. Required.
Anglo-Bulgarian, the Gena No. 0	30,000
„ „ „ No. 1	55,000
„ „ „ No. 2	10,000
One-shared Plough made in the Ryazan Factory, Trademark R Shch	20,000
Sachs swing Plough, Trademark R 6	30,000
„ Plough with Fore-Beam, Trademark DM 7	45,000
„ „ „ „ „ DM 8	5,000
The Citizen	25,000
The Reform and the Ideal, Trademarks 5–8	20,000
Total.	240,000

Tractors.

In estimating the number of tractors needed for the famine-stricken provinces, we are guided by the following considerations.

The general cultivated area of these provinces was estimated at 2,400,000 desyatinas for the year 1916. For the tilling of this area, taking the estimate of Professor M. I. Pridorogin, that one horse is required for 6 desyatinas, the number of tractile units needed would total 3,938,000. According to the reports of the year 1916, there were then 5,986,000. Again following Professor M. I. Pridorogin in the estimate that the decline in the number of horses from 1916 to the present time has been 50 per cent., we realise that the actual number of tractile units at the present time must be approximately 2,990,000. Consequently, if the land of the famine-stricken provinces is to be tilled to the same extent as in 1916, there is a shortage of about 1,000,000 tractile units. At the rate of one horse per 6 desyatinas, the corresponding cultivable area amounts to 6,000,000 desyatinas. This area, in our view, must be tilled with the aid of tractors.

In the South East, the period when tractors can plough amounts to 100 working days per annum. The type of tractor best suited for this purpose is one of 20 to 30 h.p., such as the Kletrak, the Fodzon, the Titan, or the Mogul. The amount of land which these tractors can plough in a working day is from 2 to 3 desyatinas, and therefore during the whole ploughing season each tractor can plough from 200 to 300 desyatinas. It follows that, for the ploughing of 6,000,000 desyatinas, from 20,000

to 30,000 tractors of the before-mentioned types will be needed, with the appropriate number of ploughs, or adapted for the coupling of ploughs to them.

In the famine area at the present time, according to the information received by the People's Commissariat for Agriculture there are only 177 tractors with a total power of 7,105 h.p., this being less than 0·02 per cent. of the requirements.

Harvesting Machines.

In pre-war days the annual supply of harvesting machines for Russia consisted of 166,000 machines, of which 111,000 were manufactured in Russia and 55,000 were imported. Thus the number of harvesting machines is approximately 18 per cent. of the number of ploughs. consequently we have to allow one harvesting machine for every 5·5 ploughs.

Since the term of service of a harvesting machine is on the average equal to that of a plough, namely 10 years, we can estimate the needs of the famine area in respect of harvesting machines as follows:

Samara . . .	25,000
Saratov . . .	15,000
Astrakhan . . .	4,500
Uralsk . . .	1,700
Turgai . . .	6,500
Kazan	10,000
Simbirsk . . .	8,000
Ufa	15,000
Orenburg . . .	14,000
Vyatka . . .	18,000
Stavropol . . .	12,700
Total . . .	130,400

These harvesting machines must be of the following kinds:

50 per cent. cutters-and-binders of the McCormick type.
50 per cent. harvesters of the Deering type.

Additional Requirements.

For the tractor ploughing of 6,000,000 desyatinas there will be needed: 12,000,000 poods of benzine or kerosene (reckoning two poods per desyatina); 1,500,000 poods of lubricants (reckoning 10 pounds per desyatina); 30,000 skilled workers (each tractor needs 3 workers,

of whom one must be skilled); for the work of 65,200 cutters-and-binders (taking the effective work of 1 cutter-and-binder to be 50 desyatinas in each year) there will be needed 489,000 poods of Manilla twine estimating at 6 pounds per desyatina.

Financial Outlay.

The cost in gold roubles of all the before-mentioned machinery and materials will be as follows:

715,000	Ploughs	17,875,000 Roubles.
65,200	Cutters-and-Binders	29,340,000 ,,
65,200	Harvesters	9,780,000 ,,
30,000	Tractors	300,000,000 ,,
489,000	Poods of Manilla Twine	3,420,000 ,,
	Total	360,415,000 ,,

The number of drilling-machines required in the famine area can be deduced from the ordinary numerical relationship in agricultural work between drills and ploughs.

Assuming that one 11-drill machine corresponds to eight ploughs, the number of drilling-machines required will be as follows:

Samara	17,000
Saratov	10,000
Astrakhan	3,000
Uralsk	1,200
Turgai	4,500
Kazan	6,800
Simbirsk	7,400
Ufa	10,000
Orenburg	9,700
Vyatka	12,400
	82,000

The cost of these will be approximately 10,000,000 gold roubles.

The need for hay-mowers is calculated, in accordance with data in the possession of the Samara Statistical Bureau, to be for Samara province 16,500; for the same province, 15,500 horse-rakes are needed. Assuming that the requirements of Samara province are approximately one-sixth of those of the whole famine area, we can

Combined List of the Requirements of the eleven Provinces of the South East in respect of Ploughs, Tractors, Harvesting Machines, etc.

Province.	Area sown, in Desyatinas.[1]	No. of Farms.	Ploughs.		Cutters-and-Binders.		Harvesters.		Tractors.		Manilla Twine.		Drilling- Machines.		Hay-Mowers and Horse-Rakes.	
			No.	Cost in Roubles.	No.	Cost in Roubles.	No.	Cost in Roubles.	No.	Cost in Roubles.	Amount in Poods.	Cost in Roubles.	No.	Cost in Roubles.	No.	Cost in Roubles.
Samara	4,098,000	512,804	136,000	Average cost 25 Roubles per Plough.	12,500	Average cost 450 Roubles per Cutter-and-Binder.	12,500	Average cost 150 Roubles per Harvester.	30,000 Tractors for 6,000,000 Desyatinas of Arable.	Average cost 10,000 Roubles per Tractor with Spare Parts.	93,750	Total cost 3,420,000 Roubles.	17,000	Total cost 10,000,000 Roubles.	Estimate for whole Area 190,000.	Total cost 19,000,000 Roubles.
Saratov	2,489,000	435,076	83,000		7,500		7,500				56,250		10,000			
Astrakhan	730,000	198,492	24,000		2,250		2,250				16,875		3,000			
Uralsk	279,670	43,275	9,000		850		850				6,375		1,200			
Turgai	1,013,000	140,992	36,000		3,250		3,250				24,375		4,500			
Kazan	1,634,000	445,888	54,000		5,000		5,000				37,500		6,800			
Simbirsk	1,346,000	305,513	45,000		4,000		4,000				30,000		7,400			
Ufa	2,446,000	500,543	82,000		7,500		7,500				56,250		10,000			
Orenburg	2,291,000	344,592	76,000		7,000		7,000				52,500		9,700			
Vyatka	3,003,000	593,561	100,000		9,000		9,000				67,500		12,400			
Stavropol	2,092,000	178,213	70,000		6,350		6,350				47,625		—			
	21,421,670	3,698,949	715,000	17,875,000	65,200	29,340,000	65,200	9,780,000	30,000	300,000,000	489,000	3,420,000	82,000	10,000,000	190,000	19,000,000

The grand Total of the above sums is 389,415,000 gold Roubles.

1 According to data furnished in 1919.

deduce that the total need of the area in these respects will be :

Hay-mowers . . .	100,000
Horse-rakes . . .	90,000

The cost of these machines will be about 19,000,000 roubles.

THE PRODUCTION AND EXPORT OF HIDES IN THE SOUTH EAST; THE RESTORATION OF STOCK-RAISING IN THAT AREA.

PROFESSOR G. POVARNIN.

General Considerations.

IT is difficult at the present time to give precise figures concerning the production of hides in the south-eastern area of Russia. The effects of the famine cannot as yet be definitively ascertained. Nevertheless, the known and relevant figures give some approach to accurate information, and can be accepted, with certain reserves.

The reduction of the live stock of the famine area can be estimated on the basis of the data relating to the famine in Saratov province during 1891. The table shows the percentage of slaughterings of the various farm beasts, first in normal times, secondly (estimated) during the famine period, and thirdly (estimated) after the famine.

TABLE I.—*Percentage of Slaughterings.*

Name of Farm Beast.	Normal; according to Data in the Possession of Chief-Hides.[1]	Estimated, during the Famine.	Estimated, after 1921.
Horses . . .	10	20	10
Foals . . .	30	30	25
Cows . . .	10	25	8
Bulls . . .	16·5	25	10 (4 years and upwards).
Milch-Cows . .	—	—	16·5 (natural deaths in the course of 3 years).
Heifers and Young Bulls . . .	16·5	—	5
Calves . . .	50	100	50
Sheep . . .	35	50	35
Goats . . .	35	50	35
Pigs	50	75	50

[1] Chief-Hides is the chief committee controlling the hide industry in Russia.

The number of hides reaching the market cannot correspond to the number of animals slaughtered, for some of the hides are, during the famine period (as the experience of recent years has shown), used within the locality. However, even though during the past year (owing to the desire of the peasants to avoid giving up the hides for the general use of the population) skins of medium quality were mainly consumed within the area, we have no reason to suppose that the finer skins of the large horned cattle will be locally devoted to technical purposes.

The estimate of the export of hides from this locality is based upon the calculation of the consumption of hides in the local workshops according to the data for 1917 furnished by Chief-Hides. Thanks to the vigorous development of home industries in the leather trade during recent years (industries using local skins only), the population has been less dependent on the inadequate railway service of the area with its inefficient means of transport. As a general basis of our calculations, we take the figures for the years 1916 and 1920 in the All-Russian agricultural reports.

The Restoration of Stock-Raising.

The restoration of stock-raising will be realised at different times for the various kinds of stock. Whereas the smaller live stock and the pigs, being rapid breeders, will attain their former numbers within the comparatively brief time of two or three years, provided the necessary measures are taken by the State—and the same remark applies to the horses, which have not been so greatly reduced in numbers,—as far as the larger horned cattle are concerned, the replenishment of the stock will take a considerable time, for during the famine nearly all the milch-cows, heifers, and young bulls, will have been slaughtered. A calculation will show that to restore the stock of the larger horned cattle to its pre-war level will take seven to eight years, judging by the data concerning the slaughter of these beasts during famine periods; but the government will take measures to relieve the situation.

One of the proposed measures is that for the next few years the slaughter of heifers shall be prohibited. There further presents itself the possibility (and this has been left out of the calculations) that the farms of the South East may be supplied with milch-cows and heifers from regions unaffected by the famine. Such a method can indirectly help in improving the breed of cattle in the

South East. Table II. gives the results of this calculation, and justifies the foregoing deductions, but it also shows that the restoration of stock-farming in the Mid-Volga area will be much speedier than in the Lower-Volga area.

TABLE II.

	Mid-Volga Area.			Lower-Volga Area.		
	1921.	1922.	1927–8.	1921.	1922.	1927–8.
Cows .	2,350,000	1,760,000	2,385,000	2,629,000	1,970,000	2,857,000
Bulls .	223,000	167,000	321,000	38,000	28,000	41,000
Heifers .	213,000	—	558,000	104,000	—	689,000
Young Bulls .	72,000	—	62,000	22,000	—	11,000
Milch-cows .	325,000	—	700,000	284,000	—	830,000
Calves .	1,594,000	1,180,000	1,610,000	1,788,000	1,320,000	1,920,000
	4,777,000	3,107,000	5,636,000	4,865,000	3,318,000	6,348,000
Sheep .	7,881,000	6,700,000	—	5,836,000	5,070,000	—
Goats .	522,000	443,000	—	403,000	343,000	—
Pigs .	544,000	407,000	—	979,000	733,000	—
Horses .	2,131,000	1,918,000	—	2,788,000	2,509,000	—
Foals .	290,000	959,000	—	384,000	1,254,000	—
	11,368,000	10,427,000	—	10,390,000	9,909,000	—

TABLE III.—*Production of Hides.*

	Lower-Volga Area.						Mid-Volga Area.						Totals.					
	Thick Sole Leather (Bullhide).	Thin Sole Leather, "Cow-hide" (Heifers, Young Bulls, Milch-Cows).	Horsehide and Camelhide.	Calfskin.	Sheepskin.	Goatskin.	Thick Sole Leather (Bullhide).	Thin Sole Leather, "Cow-hide" (Heifers, Young Bulls, Milch-Cows).	Horsehide and Camelhide.	Calfskin.	Sheepskin.	Goatskin.	Thick Sole Leather (Bullhide).	Thin Sole Leather, "Cow-hide" (Heifers, Young Bulls, Milch-Cows).	Horsehide and Camelhide.	Calfskin.	Sheepskin.	Goatskin.
	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6
1921	56	588	472	—	3,940	261	9	720	560	—	2,993	201	65	1,308	1,032	—	6,933	462
1922	17	176	238	567	2,340	155	3	158	251	673	1,770	121	20	334	489	1,240	4,110	276

TABLE IV.—*Output of Leather Works in the Year* 1917.

Area.	No. of Works.	No. of Hides.	Calfskins.	Other fine Skins.
Lower-Volga	333	80,575	6,864	21,434
Mid-Volga	387	272,797	57,033	78,643
	720	353,372	63,897	100,077

TABLE V.—*Number of Hides for Export.*

Year.	Lower-Volga Area.			Mid-Volga Area.			Totals.		
	Coarse Hides.	Calfskins.	Fine Hides and Sheepskins.	Coarse Hides.	Calfskins.	Fine Hides and Sheepskins.	Coarse Hides.	Calfskins.	Fine Hides and Sheepskins.
1921	1,035	—	4,080	936	—	3,094	1,971	—	7,174
1922	350	560	2,474	161	609	179	511	1,169	4,265

Concerning the value of the raw materials, we present the following estimate of the production of the South East in respect of hides. The data are furnished by Chief-Hides.

TABLE VI.—*Exports from the south-eastern Area (in Milliards of Roubles).*

Name of Export.	1921.	1922.
Coarse Hides . . .	39·42	10·22
Calfskins	—	5·8
Sheepskins and Goatskins .	28·68	16·9
Bristle	7·35	3·74
Sets of Harness . . .	4·62	2·08
Cows' Tails . . .	·37	·11
Totals .	80·44	38·85

Conclusions.

It is evident that these figures can only be approximations. The foregoing data enable us to draw the following conclusions:

(1) It will take 7 or 8 years at least to replenish the stock of the larger horned cattle in the South East. Other kinds of stock can be replenished in from 2 to 4 years. It is assumed that the government will take measures to prohibit the slaughter of young females.

(2) During the current season there was a surplus of hides, the figures being nearly equal to those of pre-war days. This especially applies to coarse hides, sheepskins, goatskins, and hair. On the other hand, in 1922, according to the estimates for that year, the number of these various kinds of hides and the quantity of hair will be greatly below that of pre-war days, and there is no likelihood of recovery in the near future.

(3) The quantity of fine hides of the larger horned cattle will probably be small both this year and for the following years.

(4) The estimates of production for 1922 are less than half of those for 1921.

THE FISHERIES OF THE SOUTH EAST.

PROFESSOR A. MEISNER.

General Characteristics.

As regards fisheries, the provinces of the South East can be classed in three groups. The first group comprises the provinces of Astrakhan and Uralsk, in which the fishing industry plays a dominant part and has considerable importance to Russia in general. The second group comprises the provinces of Tsaritsin, Saratov, Samara, Simbirsk, and Kazan, in which the fishing industry is on a comparatively small scale, so that, although it plays a considerable part locally, it has little importance to Russia at large. The third group comprises Penza, Vyatka, Ufa, and Turgai, in which the fishing industry has *per se* no importance whatever; but in Penza, Vyatka, and Ufa the home industries serving the needs of the fishing industry are of immense social importance (the supply of staves and hoops for casks, etc., pitch, tar, wooden receptacles of all sorts, fishermen's boats, etc., etc.).

The Astrakhan Area.

Astrakhan province, which includes the lower reaches of the Volga and the adjacent shores of the Caspian, is the principal fishing locality in Russia. In pre-war days, its produce amounted to about 20,000,000 poods of various kinds of fish, this being one-third of the whole product of the fisheries of the sometime empire. At the present time, in view of the reduction of the Russian fishing grounds, this area yields more than 50 per cent. of all the fish production of the Republic. In Astrakhan before the war more than 250,000 persons were engaged in the fisheries. They pursued various occupations, as fishermen, boatmen, masters, hands, etc. The greater part of the population of the province (this applies especially to Tsaritsin, which then formed part of Astrakhan), whether of Russian, Kalmuck, or Kirghiz stock, secured a livelihood mainly in the Astrakhan fisheries.

At the present time the Astrakhan area is the very centre of the Russian fisheries. If the economic life of the locality is restored, and if the further development of the industry, which has been partially ruined by the war and the revolu-

tion, be undertaken, it can provide the Republic with from 25,000,000 to 30,000,000 poods of fish per annum. At present the yearly catch is only 14,000,000 poods. The following things are essential if economic life is to be restored and if the catch is to be raised to the above-mentioned figures. First, the necessary dwellings must be built for the workers (approximately 800,000 cubic sazhenes of new buildings and repairing shops are requisite). Secondly, the fishing fleet of 250 steamboats must be thoroughly refitted, and the old and worn out vessels must be scrapped and replaced. Thirdly, the fleet of wooden boats used in the industry and for transport, which is at present only 5 per cent. of the needed strength, must be fully restored. Fourthly, the whole economy of the fishing industry must be reorganised, for it has been ruined mainly by the civil war (at the present time the fishing villages have been three-fourths depopulated; the inhabitants, under pressure of want and lacking the necessary fishing outfit, have either succumbed, or emigrated, or adopted some new occupation). Fifthly, the application of mechanical power to the fishing industry on a large scale, not only as concerns the methods of catching, but also (and this is still more important) as concerns the methods of dealing with the catch; this will require the use of numerous electric motors, the extension of railways and cable trams supplied with special freightage and transport facilities, the installation of a number of electric power stations, and so on. Sixthly, the work of preparing the fish for consumption must be reorganised, so that the consumer may receive it in the best possible condition: for this it is essential, on the one hand, that cold-storage methods should be extensively applied, including the use of cold chambers when the fish is in transit, whether by rail or by water; and, on the other hand, that there should be a great number of preserving factories, so that all the best kinds of fish can be preserved (400,000 poods of red fish; 3,000,000 poods of valuable kinds of white fish, such as giant perch, carp, white salmon, etc.). Seventhly, there must be provided a number of movable (floating) workshops for the intelligent utilisation of waste products, the saving of fats and of materials suitable for manure.

Such, in brief, are the measures essential to the development of the Astrakhan fisheries. We must also point out that this development of the fisheries is strictly contingent upon the methods employed for the improvement

of agriculture in the Volga delta, for these might be such as would interfere with the breeding of the fish and would consequently ruin the fishing industry. A close watch must therefore be kept on the improvement works in the delta, and the fishing interests must never be forgotten.

Uralsk and other Areas.

All that has been said concerning the Astrakhan area can be applied, *mutatis mutandis*, to the lower reaches of the Ural and to the town of Guriev on the Ural delta. This area is capable of supplying the Republic with more than 2,000,000 poods of fish of the very finest sorts. Especially important to this region is the improvement of its communications, first by the completion of the Alexandrov Gai and Embinsk railway, and secondly (this is even more vital) by the dredging of the mouths of the river to facilitate navigation.

As far as concerns the other provinces, the Volga and the Kama and the lower reaches of their tributaries are the most important sites of the fishing industry. The middle reaches of the Ural must also be mentioned. This area can supply the Republic with from 2,000,000 to 3,000,000 poods of fish per annum. The industry is wastefully conducted by small-scale methods, and it will perish if such conditions are allowed to persist. We must work for its reorganisation by the supply of an adequate equipment for the fisheries, and by the improvement of the methods of curing and storing fish. Salting stations, provided with cold storage, must be erected upon the banks of the rivers. Hatcheries must be established. Vessels must be supplied with special arrangements for the transport of live fish.

Conclusions.

The most pressing needs of the fishing industry are:

(1) The organisation of the cooperage industry; the provision of materials (such as hoops and staves, barrel-heads, etc., etc.). To this end it is desirable that large cooperages with machine-power equipment should be constructed in the town of Astrakhan;

(2) The organisation of the building of wooden boats. This must be mainly effected by mutual arrangements with neighbouring areas.

THE HOME INDUSTRIES OF THE SOUTH EAST.

THE present summary relates to the home industries of the provinces of Samara, Saratov, Tsaritsin, Astrakhan, Uralsk, Turgai, Vyatka, Kazan, Simbirsk, Ufa, and Orenburg. In the following exposition, the first six of these, constituting the extremely dry sub-area, will be termed the provinces of the first group; the remaining five will be termed the provinces of the second group. Area.

In the South East, large-scale industry and agriculture do not absorb all the energies of the population. For a long time, throughout this area, there has been an increasing development of home industry, availing itself of local resources in the way of raw materials. In this essay we shall classify the home industries of the area in four groups, according to the nature of the materials upon which the work is done. Thus we have: (1) wood work; (2) metal work; (3) clay, stone, and slate work; (4) work upon animal products; (5) textile work, tailoring, and rope making. Home Industry.

Home industries engaged in wood work exist, as regards the first group of provinces, in Samara, Saratov, and Uralsk, and, as regards the second group of provinces, in Vyatka, Simbirsk, Kazan, and Ufa. Among these industries may be mentioned: cart and carriage building; furniture making; cooperage; wicker work; the making of utensils out of birch bark; bast-fibre box making; travelling box making; box making; wooden utensil making and turnery; mat and sack making; bast shoe making; and the dry distillation of wood. Wood Work.

Cart and Carriage Building.—In Bugulminsk county, Samara province, there are 1,400 home industrials manufacturing farm carts and sleds; in four counties of Saratov province, there are 5,500 persons engaged in the manufacture of wagons and country carts; in Uralsk, there are 3,000 home industrials producing wagons, wheel-fellies, country carts, sleds, tarantasses, and other carriages; in three counties of Simbirsk province, there are 8,500 home industrials; in the province of Kazan, there are 9,500 home industrials producing sleds, tarantasses, country carts, wheel-fellies and wheel-hubs, etc.; in Vyatka

province, 12,300 persons are occupied as sled makers, country cart makers, wicker workers, carriage-body makers, etc.; in Ufa, there are 3,000 home industrials producing sleds and country carts. In these home industries, the total number of workers is 43,200.

Furniture Making, etc.—In Bugulminsk county, Samara province, 1,670 home industrials are engaged in the making of plain furniture; in Saratov province, there are 1,420 travelling-box makers; in Uralsk, there are 2,000 home industrials manufacturing furniture, window frames, doors, and boxes; in Simbirsk province, there are 1,800 home industrials in this branch of industry; in Kazan province, 8,500 persons work as plain furniture makers, and 870 make wooden boxes for the trade; in Vyatka province, there are 4,600 persons engaged in making plain furniture, furniture of better grade, window frames, doors, and boxes. In these home industries, the total number of workers is 20,860.

Wicker Work.—This industry is carried on in one county of Samara province (800 home industrials), two counties of Saratov province (960 home industrials), and in Simbirsk province (2,400 home industrials). In Kazan province, 6,000 persons are engaged in making baskets, wicker-work carriage bodies, and wicker furniture; in Vyatka province, there are 4,672 home workers in the basket trade and other branches of the wicker industry. This industry occupies 14,832 workers in all.

Cooperage.—In Kazan province there are 7,400 coopers, making tuns, barrels, tubs, vats, painted wooden receptacles, and buckets of various sorts; in Vyatka province, there are 2,824 coopers. Total, 10,124.

Wooden Utensils and Turned Goods.—In Saratov province, 900 persons, and in Simbirsk province 12,034 persons, are engaged in the making of cups, plates, spoons, folding screens and images, etc., scoops, troughs, hand-loom rollers, shuttles, spindles, etc. In all, 12,934 persons.

Mat and Sack Making.—In Samara province, 900 home workers, in Simbirsk, 3,100, in Kazan, 6,000, in Vyatka, 24,796, and in Ufa, 10,000, are engaged in making mats, sacking, and shoes, from the bast of the lime tree. In all, 44,796 workers are thus employed.

Dry Distillation of Wood.—This industry flourishes in Kazan province (15,000 home industrials), Vyatka (6,933), and Ufa (3,970). In all, 25,903 home industrials.

The grand total of the home industrials engaged in all these branches of the wood-working industry is 172,649.

Metal Work.

As far as the provinces of the first group are concerned, metal work is carried on in Saratov and Uralsk; and as far as the provinces of the second group are concerned, in Vyatka, Kazan, and Simbirsk. In Saratov province, a comparatively small number of persons (2,700) are engaged in the manufacture of agricultural implements, such as ploughs, ploughshares, winnowing machines, etc. In Uralsk province, there are 12,500 home workers, making stoves, pails, tea-pots, milking-pails, wash-hand basins, frying-pans, flat irons, horse-shoes, and agricultural implements and machinery. In Vyatka province, there are numerous blacksmiths, locksmiths, rivet makers, axe-forgers, shoesmiths, nailsmiths, gaff and hook makers, pail makers, stove makers, scythe makers, sickle makers, etc.; in all, 13,700 persons. In Kazan province, there are 1,500 smiths whose chief occupation is the making of tyres for carriage wheels; and there are 2,200 jewellers working in brass and in Polish silver, producing rings, bracelets, chains, etc., and the ornaments for tribal costumes. In Simbirsk province, the making of agricultural implements flourishes, and employs 1,400 workers.

In all, these home industrials engaged upon various kinds of metal work number 34,000.

Clay, Stone, and Slate Work.

Of the mineral substances used as raw materials in home industry, clay is the one most extensively employed. In the making of pottery there are engaged in Saratov province, 1,000 persons; in Simbirsk, 2,300; in Astrakhan, 2,000; in Kazan, 2,000; and in Vyatka, 4,349. In the making of tiles there are employed in Saratov province, 1,500 persons; in Samara, 200; in Simbirsk, 500; in Kazan, 1,400; in Uralsk, 4,900; and in Turgai, 785. In Saratov province 500 persons, in Simbirsk province 200 persons, and in Vyatka province 490 persons, are engaged in the making of millstones. In Saratov province there is a small industry for the manufacture of roofing slates, writing slates, and slate pencils, at which 150 persons are occupied.

The total number of these home industrials is 22,274.

Work upon Animal Products.

In this group are included tanners, leather-dressers, furriers, boot and shoe makers, saddlers, etc. These industries flourish in all the provinces both of the first and of the second group. As far as work upon hides is concerned (tanning, leather-dressing, etc.), in Samara province, there are 700 home industrials; in Saratov, 2,500; in Tsaritsin, 800; in Astrakhan, 950; in Uralsk, 1,050; in

Kazan, 2,300; in Ufa, 1,100; and in Orenburg, 660. In all, 10,060 persons. As furriers, there work in Samara province, 2,700 persons; in Saratov, 1,200; in Tsaritsin, 600; in Astrakhan, 240; in Uralsk, 920; in Turgai, 883; in Kazan, 1,800; in Simbirsk, 900; and in Orenburg, 180. Total, 9,423 persons. The boot and shoe industry occupies, in Saratov province, 3,100 home industrials; in Vyatka, 7,040; in Kazan, 4,700; and in Simbirsk, 1,250. Total, 16,090 persons. Of saddlers, there are in Saratov province, 470; in Vyatka, 3,000; in Kazan, 1,560; and in Simbirsk, 600. Total, 4,630 persons.

Thus, the grand total of these workers amounts to 40,203.

Spinning, Weaving, Fulling, Hosiery, Tailoring, and Rope making.

In Saratov province there flourishes the production of a cotton cloth known as sarpinka (the manufacture being centred in the town of Sarepta); this employs 7,000 persons. In addition, 5,000 home industrials are engaged in this province in weaving a coarser kind of cotton cloth. In Samara province, there are 3,500 linen weavers, and in Tsaritsin, 4,200; in Turgai there are cotton weavers and mat makers to the number of 1,700, in Kazan, to the number of 3,400, and in Simbirsk, to the number of 1,100; but the most vigorous development of the weaving industry is in Vyatka, where there are 52,973 hand-loom weavers, and where nearly all the peasants undertake this work. The total number of these workers is 78,873.

The most important product of the local fulling industry is felt, which is used for the making of footgear and headgear. These occupations are widely distributed in the provinces of Saratov (3,500 home industrials), Samara (1,700), Tsaritsin (1,200), Turgai (1,900), Vyatka (12,557), Kazan (7,600), and Simbirsk (3,000). In all, 31,457 persons are engaged in these occupations.

Hosiery fabrics of linen and of cotton are made in the provinces of Saratov by 3,200 workers; in Samara, by 800; in Tsaritsin, by 570; in Astrakhan, by 600; in Vyatka, by 7,970; and in Simbirsk, by 600. Total, 13,740 persons.

At the making of various kinds of rope, twine, string, whipcord, etc., there work in Saratov province 2,700 persons; in Vyatka, 1,313 persons; and in Kazan, 3,200 persons. Total, 7,213 persons.

In the tailoring trade there are engaged in Saratov province 900 home workers; in Samara, 700; in Tsaritsin, 300; in Kazan, 780; and in Simbirsk, 1,800. Total, 4,480 persons.

Thus the grand total of the home industrials in the foregoing industries is 135,763.

Summing up the number of all the home industrials engaged in various branches of productive industry throughout this area, we reach a general total of 404,889. About 43 per cent. of these are wood workers ; and 31 per cent. are engaged in the cloth making, rope making, and tailoring trades. The remaining industries absorb 26 per cent. of the home industrials.

Condition of Home Industries.

The wars, both the imperialist war and the civil war, had a very depressing effect upon home industries. The number of skilled home industrials progressively diminished ; former aptitudes were lost ; and, owing to the general scarcity, tools and methods of work had inevitably to be simplified. In Vyatka province, the production of the better kinds of furniture had to be discontinued owing to the lack of the requisite materials for finishing—the lack of varnishes and paints. In the same area, the manufacture of artistic products made of the finer qualities of wood had to be discontinued. Owing to the shortage of metals, there was a great reduction in the amount of blacksmiths' and locksmiths' work ; the production of the celebrated Orenburg kerchiefs came to an end ; in Saratov province, the manufacture of sarpinka was discontinued. Much more might be written concerning the decline in home industries. But it would be a grave error to suppose that, on the whole, the productivity of home industries has been greatly reduced during the period under consideration. Those types of home industry that are closely associated with agriculture, those for which highly finished tools are not indispensable, were able, though with difficulty, to secure the necessary raw materials on the spot, so that home industries of this type could with comparative ease survive the general economic collapse. Although, therefore, many of the highly skilled branches of production fell into decay, there was a notable increase in other branches, in unskilled occupations which began to flourish in the villages after the break-up of large-scale industry. This especially applies to the production of articles of domestic utility, to the various branches of the wood industry, to pottery making, to weaving, and finally to metal work, seeing that scythes, sickles, and other necessary tools were fashioned everywhere out of pieces of scrap iron. The tenacity of life and the stability of the home-industrial type of production is manifested by the fact that, throughout the period we

have had to live through, the co-operative organisation of home industry has been advancing. A considerable proportion of the home workers, perhaps 30 per cent. of them, are now united in productive co-operatives. According to the preliminary and incomplete information at our disposal, in the area we are considering there are at the present time, 2,080 artels (co-operatives of production) consolidated in twenty-four productive leagues.

Productivity at the present Time.

The amount produced by those home industries which are under State auspices will serve to give an index of the general productivity of home industry at the present time. In round figures, the following quantities of articles were produced in the area under consideration during 1920 and the first half of 1921; bast shoes, 14,162,000 pairs; felt boots, 2,038,300 pairs; textiles, 1,994,000 arshins; wooden utensils, etc., 14,375,000; articles of furniture, 27,000; country carts, sleds, wheels, etc., 4,280,000; casks and boxes, 520,000; mats and sacks, 1,406,000; hide tilts, 262,000; metallic articles including agricultural implements, etc., 2,045,000; articles of pottery, 1,934,000. The estimates for the production of home industries in this area during the latter half of the present year, as far as the chief lines are concerned, were as follows; wooden articles of various kinds, 30,501,199; articles of vegetable origin, 340,200; articles of animal origin, 916,000 poods; articles of pottery, 1,500,000 poods; metallic articles, 1,000,822 poods; other manufactures, 13,330,240 articles.

Importance of Increasing Productivity.

It seems urgently necessary to increase the productivity of home industry, not only for the home demand, but also for the foreign market. In the pre-war period (1904–1914), the export of various products of home industry amounted to 3,015,500 poods for the year 1904, and 5,385,200 poods for the year 1914; the exports were increasing year by year. The most important of these exports, totalling 95 per cent. of the whole, consisted of various wood products, such as laths, shingles, tar, pitch, articles of furniture, turned goods, etc. The prospects of these branches of home industry are now favourable, and there are considerable possibilities for export.

THE LOCAL SHALE BEDS AND THEIR EXPLOITATION.

PROFESSOR I. I. GUBKIN.

Local Distribution of the Shale Beds.

THE question of providing work at the shale mines for the inhabitants of the famine area is now under consideration. In this connexion, the shale beds must be considered under three heads: (1) those of the Simbirsk area; (2) those of the Sisran area; (3) eastward of the Volga, those of the Samara area and the Obshchi Syrt.

Simbirsk Area.

What is known as the Simbirsk shale bed consists of deposits of bituminous shale distributed throughout the area of the Volga-Svyaga water parting, stretching northward for nearly 30 versts along the Volga, and beginning 7 versts above the town of Simbirsk. The width of the surveyed area is, at the north end, at least 25 versts, and at the south end, not more than 7 versts. The deposits of bituminous shale consist here of seven seams, ranging in average thickness from 6 in. to 1 ft. 4 in., and having a total thickness ranging from 5 ft. 7 in. to 6 ft. 3 in. The five uppermost seams have a total thickness of 5 ft. in a total vertical extent of 12 ft. 2 in.

For the exploitation of the bituminous shale beds of the Simbirsk area there are three mines, the Undory, the Central, and the Zahareff, lying along the bank of the Volga. The first of these is at the village of Gorodishch, the second 5 versts, and the third 15 versts, below that village. At these mines the shale is worked from underground galleries. In addition, there are open workings at the village of Gorodishch near the Undory mine.

The Undory mine was opened in September, 1919. The output of bituminous shale from this date down to the first of July, 1921, was 1,700,000 poods. The total amount of shale in the whole of this area, reckoning only the five uppermost seams, is estimated at twenty-five milliards of poods.

Freshly mined bituminous shale contains 25 per cent. of moisture, but on exposure to the atmosphere the amount of moisture is rapidly reduced to from 7 per cent. to 10 per

cent. In the shale which has been thus dried, the quantity of ash ranges from 50 to 75 per cent. The heat-producing capacity of the atmospherically dried shale is from 1,900 to 2,500 calories. One cubic sazhene of bituminous shale is equivalent for heating purposes to 1·7 cubic sazhenes of wood that has been seasoned for six months, or to 2 cubic sazhenes of freshly cut timber.

Sisran Area.

This area includes part of the right bank of the Volga below the town of Sisran near the village of Kashpir, together with both banks of the river Kashpir including the village itself and the adjoining land higher up the river. The shale is obtained from four seams, both from underground and open workings. The total thickness of these four seams of bituminous shale ranges from 3 ft. 4 in. to 5 ft. in a vertical extent ranging from 8 ft. 3 in. to 10 ft. Above the seams of shale there lies an exceedingly compact sandstone, and for this reason the galleries need be timbered only at the entrance. Inside the workings, the stone arches, when properly shaped, are sufficiently stable.

Work at the Kashpir shale mine was begun at the end of 1919. Down to April 1, 1921, the output was about 950,000 poods. It is estimated that these beds contain several milliards of poods.

The Kaskpir shale is regarded as better than the Undory shale. The ash of the former ranges from 45 to 65 per cent. The heat-producing capacity of the dried Kashpir shale is 3,000 calories or more.

Transvolgian Shale Beds of Samara and the Obshchi Syrt.

Since the wide extent of land between the Ural and the Volga consists mainly of steppe, information concerning the distribution of shale beds in this area has hitherto been scanty. Nevertheless, sufficient data are forthcoming to enable us to say that there are immense shale beds within the Obshchi Syrt (the watershed between the Ural and the Volga), and we can be certain that this area contains hundreds of milliards of poods of bituminous shale.

Evidently, the quality of the shale in the Obshchi Syrt will vary in the different beds, but the available data entitle us to believe that, generally speaking, the shale of this area is of better quality than that of Simbirsk and Sisran. The seams of the Obshchi Syrt shale beds are thicker than those of Simbirsk and Sisran.

For a brief period in the year 1920 the shale of this region was mined under the auspices of Chief-Shale[1] in the vicinity of the village of Savelevk on the Sakma, a tributary of the Great Irgiz.

[1] Chief-Shale is the chief committee controlling shale mining in Russia.

The Possibilities of utilising the Volga bituminous Shales.

The Volga shale can be used for industrial purposes in the following manner.

1. As fuel in small fragments it can be burned in the furnaces of steam engines, etc. Chief-Shale has not merely secured designs for furnaces adapted to the peculiarities of shale as fuel, but has experimental furnaces actually at work.

2. As fuel in the pulverised form. Shale can thus be adapted for use in cement works that are now lying idle. In this branch of industry the whole of the shale can be used without any waste, for the ash from the furnaces is serviceable for the making of cement.

3. As fuel for electric power stations. Under this head, in addition to the methods mentioned under heads 1 and 2, shale can be used as follows. The shale is converted into gas in gas generators so constructed that the process of gasification protracts the development of the process of dry distillation. As a result we get the following products: (*a*) gas which can be burned in the furnaces of steam engines, or used as fuel for internal combustion engines; (*b*) shale pitch, which is of just as good quality as the pitch secured in shale-distilling retorts.

4. For the manufacture of shale tar in special retorts. Shale tar can be used: (*a*) after purification from sulphur as a raw material for the manufacture of petroleum-like products; (*b*) the sulphide being retained, as raw material for a whole series of products.

(α). Fireproof products for the impregnation of wood used for roofing, railway trucks, etc.

(β). Extremely valuable fire-resisting products for the impregnation of railway sleepers, etc.

(γ). As a substitute for coal-tar pitch in the manufacture of asphalt, and in the manufacture of fireproof pasteboard.

(δ). Sulphur products for the manufacture of ichthyol and other drugs, and for the manufacture of soap.

(ϵ). Ammonium sulphite, valuable as manure, and used for the manufacture of sulphate of ammonia.

(ζ). Materials for carbonisation in the production of electric stoves, brush lights, etc.

PUBLIC WORKS IN THE FAMINE AREA.

THE failure of the crops in the greater part of the Volga basin has brought to the front the question of the struggle with the consequent famine. Assistance to the hunger-stricken population can take two main forms: the first of these consists merely of direct aid; the second is the productive utilisation of all the elements of the population that are fit for work. The latter method of rendering aid is of course the more advantageous, for it enables us to increase the material resources of the country and to enrich it in all sorts of ways. It is self-evident that, in choosing work, attention must be paid to the kinds of labour available. Under the conditions existing in the famine area. suitable occupations are: timber work; building operations; land improvement schemes. On these lines there must be drawn up a program of public works in the famine area.

The Area in which Public Works must be undertaken.

At the present time, public works should be undertaken in the provinces of Tsaritsin, Saratov, Samara, Simbirsk, Uralsk, Vyatka, Astrakhan, Tartar Republic, the Chuvash and Marii regions, and the German Volga Commune.

Timber Work.

The most extensive task that awaits us is timber work in the Marii and Chuvash regions. Two hundred and forty thousand desyatinas of wood land were devastated by forest fires this year. Unless the grubbing up of the tree stumps is undertaken throughout the affected area, a considerable quantity of valuable fuel will be wasted, and reafforestation will be difficult for a long time to come. Hence the clearing of the burned area is a task of immediate importance. In the forthcoming season from September 1, 1921, to January 1, 1922, it ought to be possible to prepare and transport 500,000 cubic sazhenes of wood. This work will occupy as many as 160,000 persons, to feed whom there will be required about 908,000 poods of flour, not to mention other articles. The cost will amount to 1,577,000 gold roubles.

Land Improvement Schemes.

Land improvement schemes will occupy 140,000 workers. Their cost will be 5,500,000 gold roubles. The quantity of flour needed will be 840,000 poods.

Preparation of Building Materials.

The preparation of the tiles, cement, gypsum, asphalt,

etc., needed for building operations in the famine area will occupy 15,000 persons. Cost, 600,000 gold roubles. Quantity of flour needed, 90,000 poods.

Public Buildings.

The most important public buildings immediately required in the famine area are repairing stations, isolation sheds for persons suffering from cholera and other epidemic diseases, and infirmaries, amounting in all to 10,000 cubic sazhenes. Twenty-five thousand workers will be needed; the flour requisite will amount to 150,000 poods; the cost will be 1,000,000 gold roubles.

Road Repair.

In the famine area it is necessary to undertake the repair of 10,000 versts of high roads which were entirely neglected during the war and are in an extremely bad condition. This will occupy 50,000 workers. Cost, 2,000,000 gold roubles. Flour requisite, 300,000 poods.

Railway Construction.

The building of two branch lines for the transport of fuel has been planned, the Simbirsk-Undory railway and the Yakushinsk railway. The length of the two will be 66 versts. Workers required, 4,000. Cost, 150,000 gold roubles. Flour needed, 24,000 poods.

Waterworks.

Waterworks are planned for the provinces of Saratov, Astrakhan, and Tsaritsin. Labour, 6,000 persons. Cost, 240,000 gold roubles. Flour, 36,000 poods.

Home Industries.

Considerable importance must be attached to the support of the home industrials of the famine area. It is proposed to assist 200,000 home workers by buying up the produce of their labour and by supplying them with raw materials. This scheme will involve a total cost of 2,500,000 gold roubles.

Local Undertakings.

In addition to work organised by the central authority, various local undertakings have to be considered. Thus, in Volsk county, Saratov province, it is proposed to prepare the stone needed for the thorough repair of the bridges on the Volsk-Cherkass railway, 30 versts in length. The cost will be 54,000 gold roubles, and 76,000 workers will be employed. In the same county it is proposed to build a wooden bridge across the Terzyanka. The number of workers needed will be 76,580, and the cost will be 41,000 gold roubles. In Khvalinsk county it is proposed to prepare the road metal for the thorough repair of the road from Khvalinsk to Tartar Shemelok. The cost will be 40,000 roubles, and the number of workers employed will be 67,000. In Kamyshin county, metal is to be prepared for the making of the Rudnyansk road and for the strengthening of the dam upon a tributary of the river Ilovlya. These undertakings will employ 45,000

workers, and will cost 300,000 gold roubles. In Saratov county, two works have been planned: first, the levelling of the sandhill in Kamenka village, which will employ 50,000 workers and will cost 35,000 gold roubles; and secondly, the completion of the road between Idolga and Tatirev, which will employ 59,000 workers, and will cost 50,000 gold roubles.

In the Tartar Republic, waterworks are planned for 9 places, and various roads have to be made in accordance with an agreement. The number of workers employed will be 19,400, and the cost of the work will be 4,000,000 gold roubles.

For the Tartar Republic there have also been planned extensive land improvement works, taking the form of cleansing the meadows in the river basins. This concerns an area of 40,000 desyatinas in the valleys of the Volga, the Kama, the Svyaga, and the Vyatka. It is estimated that the returns from the scheme will amount to 6,000,000 poods of hay, worth locally 3,000,000 gold roubles. An additional product of this work will be 400,000 cubic sazhenes of brushwood, worth 4,500,000 gold roubles.

It is further proposed to construct 1,000 reservoirs, in part for the storage of water, and in part for piscicultural purposes. An additional proposal is the construction of 1,000 clamps for the storage of 40,000,000 poods of potatoes. If we assume the saving of potatoes thus effected to be 20 per cent., the gain achieved will be 8,000,000 poods of good potatoes worth 20,000,000 gold roubles at present prices. The cost of these proposed works will be 30,000,000 gold roubles.

In Samara province, the proposed repair of the waterworks and of the roads, together with the cleansing of the town, will involve a total cost of 330,000 gold roubles.

In Uralsk region there are plans for the irrigation of the land lying along the river Kushum, on the Great Uzen, in the Chizhev marshes, and on the Algeba. The extent of land to be irrigated amounts to 52,455 desyatinas, and this will require the work of 36,000 persons. Returns of immense value are expected from these works. For example, merely within the area of the Chizhev marshes, the irrigation works will, it is estimated, lead to a hay crop of as much as 30,000,000 poods.

To sum up, all the work contemplated will give employment to about 1,000,000 persons, and will cost about 19,000,000 gold roubles.

In calculating the cost of the work, the cost of supplying

the natural requirements of the workers has not been included. If we assume, as is done in the estimates of the Chief Committee for Public Works, that the daily upkeep of one worker expressed in terms of bread is equivalent to 5 lbs. of bread, then the total requirements for one year will be 46,000,000 poods, and to the end of the present year 12,000,000 poods.

TABLE.—*Public Works planned in the Famine Area down to January* 1, 1922.

Kind of Work.	Amount of Work.	No. of Workers required.	Amount of Flour required, in Poods.	Total Cost in Gold Roubles.
STATE UNDERTAKINGS.				
(1) Timber Work	500,000 cubic sazhenes.	160,000	908,000	1,577,000
(2) Land Improvement Schemes	—	140,000	840,000	5,500,000
(3) Preparation of Building Materials	—	15,000	90,000	600,000
(4) Public Buildings	10,000 cubic sazhenes.	25,000	150,000	1,000,000
(5) Road Repair	10,000 versts.	50,000	300,000	2,000,000
(6) Railway Construction	66 versts.	4,000	24,000	150,000
(7) Waterworks	—	6,000	36,000	240,000
(8) Home Industries	—	200,000	—	2,500,000
LOCAL UNDERTAKINGS.				
(1) Railways, Roads, etc.	—	373,000	—	520,000
(2) Waterworks	—	19,000	—	4,000,000
Totals	—	992,000	2,348,000	18,087,000

SKETCH OF THE INDUSTRIES OF THE SOUTH EAST.

P. KOLOKOLNIKOFF.

General Survey.

THE character of the industry of the South East and the conditions of its general development are explained by the character and the developmental conditions of the agriculture of this area.

The South East is not one of the industrial regions of Russia. The industrial report for the year 1918 (which, indeed, thanks to the incidence of the civil war, failed to embrace the whole of the area with which we are concerned) recorded 2,195 enterprises and about 113,000 operatives—exclusive of the petty production of the home industrials. As between the two sub-areas distinguished in previous essays, these undertakings and operatives were distributed as follows:

Sub-Area and Provinces.	Enterprises.	Operatives.
Mid-Volga (Kazan, Simbirsk, and Vyatka) . . .	709	68,359
Lower-Volga (Samara, Saratov, and Astrakhan) . .	1,486	45,033
Totals . . .	2,195	113,392

This represented 22 per cent. of the enterprises and 9 per cent. of the operatives of Central Soviet Russia of that date; and it represented 12 per cent. of the enterprises and 5·5 per cent. of the operatives in the whole of Russia, including Siberia and Ukraine. At the same epoch, the sown area of the South East constituted one-fourth of all the sown area of European Russia.

In the South East there are more people engaged in the

elaboration of agricultural products than in any other single industry. Witness the following figures:

Sub-Area.	No. of Under-takings.	No. of Operatives.	Percentage of Under-takings.	Percentage of Opera-tives.
Mid-Volga.	292	4,053	41	6
Lower-Volga	978	13,662	66	30
	1,270	17,715	58	16

The percentage of the industries engaged in the elaboration of agricultural products, as compared with Central Russia and Russia as a whole, was as follows:

	Undertakings.	Operatives.
Central Russia . .	38	22
The whole of Russia .	17	6

In the South East were concentrated two-fifths of all such industrial undertakings of Central Russia. In this respect, the only area comparable to the South East was Ukraine; but in the latter, as will be plain from what follows, this branch of industry assumed a different character. In the industrial life of the South East, this particular kind of industry occupied more than half of the undertakings and nearly one-fifth of all the operatives. Furthermore, the elaboration of agricultural products was much more decisively concentrated in the Lower-Volga sub-area. The industry of the Mid-Volga sub-area was more diversified. Thus, in Simbirsk province there was a vigorous development of the production of coarse woollen cloth (17 enterprises, and 10,500 operatives, according to the 1918 report). This branch of industry, genealogically descended from the factory labour carried on by serfs in former days, is geographically associated with Tambov and Penza provinces, being dependent for supplies upon local sheep farming, with the destinies of which its own fate is incorporated. In so far as the adoption of intensive

methods of agriculture interfere with sheep farming (since the sheep is an animal giving comparatively slow returns), so far, necessarily, will the foundation of this branch of industry be undermined. The same remark applies to the fulling industry of the Kazan-Kukmorsk area, which up to now has constituted 20 per cent. of the whole fulling industry of Russia. In Vyatka province, metal works and machine-making play a considerable part. In these industries there were here 14 factories employing 23,500 operatives; among them are the Votinsk and Izhevsk factories. There were also many chemical works in Kazan and Vyatka provinces (28 enterprises employing 4,500 operatives). Finally, in Kazan province, there were 23 tanneries employing 5,500 operatives. Turning to the Lower-Volga sub-area, we must first of all refer to the salt industry of Astrakhan (34 salt works, employing 3,000 operatives). A notable industry in this part of the world is cooperage, the making of wooden receptacles for use in the fish-packing industry (66 cooperages, employing 3,000 operatives). As far as Saratov province is concerned, we must refer to the textile industry, the manufacture of sarpinka (Sarepta cottons) and coarse woollen cloth (11 enterprises, employing 3,500 operatives). The local machine shops (60 undertakings, employing 4,500 operatives) served—apart from war-time industries—almost exclusively to provide for the requirements of water transport and the flour-milling industry.

Although at the present time all branches of industry except those concerned with food production are at a low level in the South East, it by no means follows that the industry of this area will not develop greatly in the future. The geographical movements in economic life induced by the war and the revolution will give an impetus to industry in the South East as well as elsewhere. The special investigation concerning the electrification of the Cisvolgian area has shown that there are very favourable prospects for the development of the engineering industry in the towns on the Volga, and especially in Tsaritsin. Engineering workshops in this area will be able to supply the demands of the rural population for farming implements, machinery, etc., and to meet the requirements of water transport. The manufacture of cement and the manufacture of artificial manures also have a great future. The erection of local slaughter-houses and the utilisation of the offal of the fishing industry will promote the work of elaborating animal products, fats, etc., and will foster the

development of the albumin industry, glue making, bone calcining, tallow melting, soap boiling, and so on. Less favourable are the prospects of the various wood-working industries, owing to the lack of the necessary raw material in the southern steppe region of the South East. Tsaritsin, however, has long served as a depot for the supply of the Don basin with wood received in the rough by the Kama and the Volga rivers (the Tsaritsin sawmills).

All the above-mentioned branches of industry belong to large-scale and medium-scale factory and workshop production. The home industries of the South East are not very extensive. They are chiefly concentrated in the northern parts of the area (the various kinds of wood work in the forest regions of Simbirsk, Kazan, and Vyatka provinces ; fulling, and the leather industry in Kazan and Vyatka provinces). We cannot count upon much development of home industry in this area, except concomitantly with the intensification of agriculture.

Industries concerned in elaborating the Products of Agriculture.

Turning, now, to the industries concerned in the elaboration of agricultural products, we must emphasise at the very outset that they have an ineffaceable stamp impressed upon them by the predominance of grain crops in the ploughlands and the extensive character of the stock-raising practised in the steppes. In the south-western parts of Russia there are many sugar refineries, owing to the prevalence here of sugar-beet cultivation. In White Russia, distilleries abound, for there potatoes are a staple crop. In the northern part of the Volga basin, starch and glucose are manufactured on a considerable scale. In the black-earth regions of Central Russia, finally, where pig-farming flourishes in the provinces of Tambov and Voronezh, there has been during the last ten years a considerable development in the meat-preserving industry. In the South East, on the other hand, flour-milling predominates among the industries based upon the elaboration of agricultural products. Until recently the cattle of the steppe were brought in droves to the markets of Central Russia ; the inauguration of slaughter-houses in the South East and the provision of cold-storage facilities in the area were still in the germ. Poorly developed, likewise, in the South East were the confectionery trade and the tobacco industry, which gravitate towards the regions of vigorous demand. The growth of these branches of industry was hindered by the paucity of the local demand and the sluggishness of movement in local industrial life. Speaking generally we may say that

the industries of the South East engaged in the elaboration of agricultural products and working with local materials, did not work for the local market but for Central Russia, and that their fate was bound up with the fate of the Central Russian market. But whereas in the South and the South West agriculture, and consequently the industries based upon agriculture, worked chiefly for the foreign market, in the South East they worked chiefly for the Russian market.

The following table shows the general lines of the industries in the South East that are based upon agricultural production (year 1912):

Factories and Workshops.	Mid-Volga Sub-Area.		Lower-Volga Sub-Area.		Totals.[1]	
	No. of Enterprises.	No. of Operatives.	No. of Enterprises.	No. of Operatives.	Enterprises.	Operatives.
Flour Mills	36	1,070	137	5,103	173	6,173
Distilleries	90	2,314	50	1,118	140	3,432
Oil Presses	3	121	33	1,098	36	1,219
Starch and Glucose Factories	8	275	4	104	12	379
Sugar Refineries	—	—	264	650	264	650
Breweries	12	839	18	912	30	1,751
Tobacco Factories	3	157	2	780	5	937
Macaroni and Vermicelli Factories	2	80	3	319	5	399
Confectionery Works	5	317	9	408	14	725
Sausage, Potted Meats, etc., Works	2	26	7	105	9	131
Totals	161	5,199	527	10,597	688	15,796

Of these enterprises, 41 per cent. are engaged in the flour-milling industry, and 39 per cent. of the operatives are thus employed. Distilling occupies the second place, with 33 per cent. of the enterprises and 22 per cent. of the operatives. In these two branches, in the year 1912, there were engaged three-fourths of all the undertakings and more than half of all the operatives. Among other branches of industry working for the All-Russian market, the most notable is the oil-pressing industry, which is almost exclusively carried on in Saratov province. The starch and glucose industry has not developed outside of Simbirsk province. Among the branches of industry working for the local market, two may be mentioned:

[1] These figures refer to large-scale and medium-scale industry, not to home industries.

brewing, which is equally distributed throughout the provinces, with the exception of Simbirsk; and tobacco manufacture, which flourishes mainly in Saratov.

By a further comparison of the Mid-Volga and Lower-Volga areas we are enabled to note: (*a*) the greater development of the industries elaborating the products of agriculture; and (*b*) the greater uniformity of production, in the Lower-Volga sub-area. In Lower-Volga, flour milling occupies 52 per cent. of the undertakings and 67 per cent. of the operatives, whereas in Mid-Volga this industry occupies only 22 per cent. of the enterprises and 21 per cent. of the operatives. Conversely, distilling is more strongly developed in the Mid-Volga sub-area, for here it occupies 56 per cent. of the enterprises and 44 per cent. of the operatives, whereas in Lower-Volga only 19 per cent. of the enterprises and 11 per cent. of the operatives are engaged in distilling.

The data of the reports for the year 1918 confirm the conclusions based upon the tables of 1912.

Enterprises.	Provinces.			
	Samara.	Saratov.	Simbirsk.	Vyatka.
Flour Mills . .	380	524	124	2
Distilleries and Breweries . .	35	44	70	17
Oil Presses . .	—	34	—	—
Starch and Glucose Factories . .	—	—	4	—
Sugar Refineries. .	2	—	—	—
Tobacco Factories .	1	2	—	1

The number of operatives in the flour mills was as follows:

Provinces.	Reports for 1918.	Estimates for 1920–1921.
Samara .	4,742	11,208
Saratov .	3,261	7,556 (including Tsaritsin province).
Simbirsk .	1,148	1,395

Obviously the estimates for 1920–1921 must include the small flour mills of the peasants.

Not merely is flour milling the predominant branch of industry in Samara and Saratov provinces. As we learn from the following table, the larger moiety of the great mills is concentrated in these two provinces.

Year 1908.	Provinces.		
	Samara.	Saratov.	Simbirsk.
Flour Mills			
Large . . .	137	141	49
Medium-sized . .	157	140	54
Quantity of Grain Milled, in Poods			
In the Large Mills .	44,000,000	51,000,000	15,000,000
In the Medium-sized Mills . . .	65,000,000	79,000,000	26,000,000

Samara, Saratov, and Tsaritsin have for a considerable period been important centres of the milling industry. Nevertheless, a considerable part of the harvest was exported from the area in the form of grain, and was sent to be milled either in the Upper Volga or in the metropolis. This took place, not only owing to the cheapness of water transport, but also because the local stock-farmers made no demand for the by-products of the milling industry, so that the bran, etc., was sent away. The adoption of intensive methods of stock-farming will lead to an intensive development of the local milling industry, and will at the same time encourage the growth of new branches of industry associated with agricultural life, such as oil pressing, the manufacture of potted meats, etc.

The adoption of intensive methods of stock-farming must go hand in hand with intensive culture of the soil, and this, too, will encourage the growth of various industries elaborating the products of agriculture. The inclusion of root crops, such as potatoes and beetroots, in the rotation of the crops will encourage the development of the beet-sugar industry and of the starch and glucose industry, so that the produce of the vegetable gardens

along the Volga can be fully utilised. Furthermore, the by-products of these two industries will furnish concentrated fodder for live stock, and this in its turn will stimulate the development of stock-farming. Thus the destinies of the industries elaborating the agricultural products of the South East are indissolubly associated with the destinies of agriculture itself.

APPENDIX I.

LIST OF EXPERIMENTAL INSTITUTIONS IN THE SOUTH EAST.

In Saratov Province.

(1) Saratov region. Farming experimental station. (In existence more than 10 years.)

(2) Petrov experimental station.
(3) Serdob " "
(4) Balashev " "
(5) Kamyshin " field.
(6) Kuznets " "
(7) Volsk " "
(8) Atkarsk " "

} working from 8 to 10 years.

(9) Krasnokut experimental station (since 1910).
(10) Kostychev experimental station (since 1895).
(11) Valuisk experimental irrigation section (since 1890).
(12) Experimental field of the Marii Agricultural College.

} Novouzensk county.

(13) Experimental Institute of the Agronomical Faculty of the University of Saratov.

In Tsaritsin Province.

(1) Tsaritsin experimental field.
(2) Tingutin irrigation section (15 years in being).

In Samara Province.

(1) Bezenchuk experimental station, Samara county (since 1905).
(2) The farm of the Samara Agricultural School near Kinel railway station.
(3) Alekseyev experimental station in the southern part of Buzuluk county (since 1911).
(4) Buguruslan experimenta lfield (working for more than 15 years).
(5) Bugulma experimental field.
(6) Buzuluk experimental field.

In Uralsk Region.

(1) Temir experimental field (working for about 10 years).

In Astrakhan Province.

(1) Horticultural experimental section (near the Town of Astrakhan).

APPENDIX II.

ITEMS RELATING TO THE SURPLUS AND THE DEFICIT, RESPECTIVELY, OF THE CHIEF PRODUCTS.

(Compiled from Data relating to the Period 1907–10.)

THE details of transport by rail and by water supply valuable information concerning the characteristics of the area. A detailed study of this kind would be extremely interesting. It would enable us to determine the resources of each locality at a given time, and would be a guide to action in case of need. Unfortunately, a complete investigation of this character would be a lengthy affair. The Department of Rural Economy and Statistics of the People's Commissariat for Agriculture is already at work on these lines, but the undertaking is still far from being completed. We shall, therefore, content ourselves with presenting average results relating to the period 1907–1910. In a few instances, the figures relate to 1907–1909, and are based upon the work of Professor A. N. Chelintseff.

We shall begin with data relating to all the cereals, treated as a general total.

Province.	Surplus (+) Deficit (−) of all Cereals, in Poods.	Consumption per Inhabitant, in Poods.
Astrakhan . .	− 31,488,000	9·2
Kazan . . .	+ 21,492,000	19·3
Nizhni-Novgorod .	− 4,212,000	21·1
Orenburg . .	+ 28,439,000	19·1
Penza . . .	+ 13,543,000	26
Samara . . .	+ 76,223,000	15·1
Saratov . . .	+ 41,166,000	17·4
Simbirsk . .	+ 14,351,000	22·6
Ufa . . .	+ 33,612,000	21·2

All these provinces, with the exception of Astrakhan and Nizhni-Novgorod, produce a surplus of cereals.

Now we shall consider the surplus and deficit of the four chief cereals.

Province.	Wheat and Wheaten Flour, in Poods.	Rye and Rye Flour, in Poods.	Oats, in Poods.	Barley, in Poods.
Astrakhan .	+ 2,191,000	— 649,000	— 1,322,000	— 54,000
Kazan . .	— 2,003,000	+16,373,000	+13,605,000	— 27,000
Nizhni-Novgorod	— 2,636,000	— 1,208,000	— 548,000	— 1,000
Orenburg . .	+23,191,000	+ 1,461,000	+ 2,847,000	— 90,000
Penza . .	— 642,000	+ 5,599,000	+ 9,102,000	— 38,000
Samara . .	+97,442,000	+14,413,000	+ 312,000	— 51,000
Saratov . .	+23,875,000	+13,887,000	+15,223,000	— 373,000
Simbirsk . .	+ 3,307,000	+ 7,409,000	+ 6,131,000	—
Ufa . . .	+ 6,078,000	+29,274,000	+ 8,272,000	— 70,000

It is to be observed that all these provinces suffer from a deficit of barley. The provinces of Orenburg, Samara, Saratov, Simbirsk and Ufa grow a surplus of the other three cereals. The provinces of Kazan and Penza are obliged to import wheat. Astrakhan province has to import three of the cereals, and has a surplus of wheat alone.

Surplus and Deficit of Potatoes and Starch.

Province.	Potatoes, based on the 1907–1909 Data, in Poods.	Starch, based on the 1919 Data, in Poods.	Amount of Potatoes for Distilleries based on the 1907–1910 Data, in Poods.
Astrakhan .	— 28,000	—	—
Kazan . .	—	+ 1,000	1·700
Nizhni-Novgorod	+ 292,000	— 1,000	0·800
Orenburg . .	— 39,000	— 10,000	0·500
Penza . .	+ 878,000	+ 182,000	8·900
Samara . .	— 52,000	— 2,000	0·950
Saratov . .	— 570,000	— 8,000	1·900
Simbirsk . .	— 99,000	+ 170,000	2·900
Ufa . . .	+ 28,000	+ 9,000	1

Penza province produces the most notable excess of potatoes. This province, therefore, is foremost in the export of potatoes and of starch; but the bulk of the potatoes grown here are consumed in the distilleries. In the remaining eight provinces this tuber does not play an important part, and, though Nizhni-Novgorod and Ufa produce a surplus, all the remaining provinces have to import large quantities of potatoes.

Surplus and Deficit of the Main Vegetable Crops.
(*Average of* 1906–1908.)

Province.	Cabbage (per slow Goods Train), in Poods.	Onions (per slow Goods Train), in Poods.	Fresh Vegetables (per fast Goods or per Passenger Train), in Poods.
Astrakhan .	+ 2,000	—	+ 4,000
Kazan . .	—	— 3,000	—
Nizhni-Novgorod	+ 20,000	+ 10,000	+ 7,000
Orenburg . .	+ 8,000	— 70,000	— 3,000
Penza . .	+ 65,000	+ 185,000	—
Samara . .	— 5,000	— 11,000	+ 10,000
Saratov . .	— 52,000	— 77,000	+ 23,000
Simbirsk . .	— 10,000	— 26,000	+ 6,000
Ufa . . .	—	+ 59,000	— 2,000

Vegetable growing does not play any considerable role in the husbandry of this area. Penza and Nizhni-Novgorod alone export a fairly large quantity of cabbages and onions. The remaining provinces do not export any vegetables, but neither do they need to import any notable quantity.

We must not fail to point out that there is a considerable export of water-melons from Samara, Saratov, and Astrakhan provinces.

Surplus and Deficit of Fruit.

Province.	Water Melons, Average of 1906–1908, in Poods.	Cucumbers (per Goods Train), Average of 1906 1907, in Poods.	Apples, Average of 1906 1909, in Poods.
Astrakhan .	+ 640,000	—	(+ 4,000)
Kazan . .	(+ 9,000)	—	(— 21,000)
Nizhni-Novgorod	(+ 58,000)	+ 1,000	— 15,000
Orenburg . .	— 44,000	— 8,000	— 135,000
Penza . .	— 157,000	—	— 104,000
Samara . .	+ 207,000	—	— 210,000
Saratov . .	+ 651,000	— 1,000	(— 114,000)
Simbirsk . .	(+ 79,000)	—	+ 16,000
Ufa . . .	— 119,000	—	— 70,000

Among crops grown for industrial purposes are flax and hemp. Raw flax is exported from Kazan, Nizhni-Novgorod, and Orenburg provinces, while hemp is exported from the province of Penza.

Oleaginous seeds are exported from all the above-mentioned provinces with the exception of Astrakhan, Nizhni-Novgorod, and Penza; but, since there are practically no oil-presses in the area, most of the provinces are obliged to import vegetable oil. Orenburg, Saratov, and Penza form an exception, for

these provinces, making use of imported seeds, extract the oil from them and thus manufacture a valuable export.

Surplus and Deficit of Raw Flax and Hemp. (*Average of* 1907–1909.)

Province.	Flax, in Poods.	Hemp, in Poods.
Astrakhan	— 1,000	—
Kazan	+ 132,000	— 6,000
Nizhni-Novgorod	+ 130,000	— 231,000
Orenburg	+ 33,000	— 5,000
Penza	— 2,000	+ 352,000
Samara	— 35,000	+ 4,000
Saratov	—	+ 18,000
Simbirsk	— 8,000	+ 120,000
Ufa	+ 5,000	— 5,000

Surplus and Deficit of Oleaginous Seeds, Vegetable Oil, and Oil-Cake. (*Average of* 1907–1909.)

Province.	Oleaginous Seeds.	Vegetable Oil.	Oil-Cake.
Astrakhan	— 40,000	— 34,000	+ 1,000
Kazan	+ 291,000	— 273,000	(— 1,000)
Nizhni-Novgorod	— 92,000	— 53,000	+ 347,000
Orenburg	+ 1,201,000	+ 23,000	— 391,000
Penza	— 33,000	+ 77,000	— 210,000
Samara	+ 99,000	— 78,000	(— 43,000)
Saratov	+ 106,000	+ 569,000	+ 1,187,000
Simbirsk	+ 195,000	— 60,000	(— 24,000)
Ufa	+ 230,000	— 69,000	— 33,000

There is a surplus of bran in all the provinces mentioned in the tables, but hay is not produced in such abundance, and Penza and Saratov are even obliged to import this fodder.

Surplus and Deficit of Bran and of Hay. (*Average of* 1907–1909.)

Province.	Bran, in Poods.	Ratio to total Grain milled, in Poods.	Hay, in Poods.
Astrakhan	+ 2,000	— 1,000	+ 12,000
Kazan	(— 300)	—	+ 35,000
Nizhni-Novgorod	+ 1,407,000	+ 3,000	+ 500,000
Orenburg	+ 1,183,000	+ 3,000	+ 340,000
Penza	+ 445,000	+ 2,000	— 287,000
Samara	+ 542,000	+ 900	+ 160,000
Saratov	+ 2,618,000	+ 3,000	— 628,000
Simbirsk	+ 499,000	— 2,000	—
Ufa	+ 2,000	—	—

Surplus and Deficit of Large Horned Cattle: Carcasses transported by slow Goods' Train and fast Goods Tain. (Average of 1907–1909.)

Province.	Large Horned Cattle, in Poods.	Carcasses conveyed by slow Goods Train, in Poods.	Carcasses conveyed by fast Goods Train, in Poods.	Large Horned Cattle per 100 Desyatinas of farming Land.
Astrakhan .	(+ 700)	(— 4,000)	— 400	(+ 500)
Kazan . .	+ 200	— 6,000	— 37,300	—
Nizhni-Novgorod	— 100	+ 170,000	+ 10,300	+ 5,800
Orenburg . .	+ 68,200	+ 712,000	+ 11,100	+ 11,200
Penza . .	+ 1,500	+ 80,000	+ 6,800	+ 3,500
Samara . .	+ 60,300	+ 122,000	— 2,000	+ 7,000
Saratov . .	+ 74,500	+ 275,000	+ 7,200	+ 8,300
Simbirsk . .	+ 3,900	+ 148,000	+ 1,400	+ 6,500
Ufa . . .	+ 900	+ 159,000	+ 3,100	+ 2,700

Large horned cattle and pigs are exported from all the above-mentioned provinces, with the following exceptions: Nizhni-Novgorod, which suffers from a dearth of large horned beasts; and Astrakhan, which lacks pigs for export. But the deficiency does not assume any notable proportions.

As far as carcasses of large horned cattle and pigs are concerned, the export of these from all the provinces (excluding Astrakhan) is considerable.

Surplus and Deficit of Pigs and Pork. (Average of 1906–1909.)

Province.	Pigs, in Poods.	Pork conveyed by slow Goods Train, in Poods.	Pigs per 100 Desyatinas of Farming Land.
Astrakhan .	— 100	— 300	— 200
Kazan . .	+ 100	+ 1,000,000	+ 5,000
Nizhni-Novgorod	+ 3,900	+ 115,000	+ 10,000
Orenburg . .	+ 1,100	+ 96,000	+ 14,100
Penza . .	+ 12,100	+ 249,000	+ 20,900
Samara . .	+ 700	+ 70,000	+ 11,100
Saratov . .	+ 4,100	+ 90,000	+ 3,900
Simbirsk . .	+ 1,100	+ 179,000	+ 11,300
Ufa . .	—	+ 44,000	+ 500

Surplus and Deficit of Butter (per slow Goods and fast Goods Train), of Milk (per fast Goods and passenger Train), and other Dairy Produce (per fast Goods and passenger Train). (Average of 1907–1909.)

Province.	Butter, in Poods.	Milk, in Poods.	Other Dairy Produce, in Poods.
Astrakhan .	— 300	—	—
Kazan . .	— 200	+ 100	— 3,100
Nizhni-Novgorod	+ 73,300	+ 800	+ 1,400
Orenburg .	+ 83,300	—	— 3,700
Penza . .	+ 11,800	—	— 2,300
Samara . .	— 3,200	+ 300	— 1,900
Saratov . .	— 6,500	— 28,000	— 16,500
Simbirsk . .	+ 2,200	+ 100	+ 1,500
Ufa . . .	+ 17,000	—	— 1,500

There is a surplus of butter in Nizhni-Novgorod, Orenburg, Penza, Simbirsk, and Ufa provinces; the remaining provinces do not suffer from dearth to any notable extent. The supply of fresh milk and other dairy produce is shown to be inconsiderable.

Surplus and Deficit of Horses (Average of 1907–1908), and Sheep (Average of 1907–1909).

Province.	Horses.	Sheep.
Astrakhan . .	+ 100	+ 300
Kazan . . .	+ 100	+ 600
Nizhni-Novgorod .	+ 800	—
Orenburg . .	+ 1,000	+ 400
Penza . . .	+ 4,600	+ 4,500
Samara . . .	+ 100	+ 600
Saratov . . .	+ 6,100	+ 10,700
Simbirsk . .	+ 3,100	+ 100
Ufa . . .	+ 200	— 300

Every province shows a surplus of horses. The surplus is more considerable in Penza, Saratov, and Simbirsk provinces. We must not fail to point out the important role played by this abundance of horses in stocking the Russian markets.

The table shows that sheep form an insignificant export in these provinces.

Surplus and Deficit of Eggs (Average of 1907–1909), Live Fowls (Average of 1909), and slaughtered Fowls (Average of 1910).

Province.	Eggs, in Poods.	Live Fowls, in Poods.	Slaughtered Fowls, in Poods.
Astrakhan .	—	—	— 1,300
Kazan . .	+ 939,000	— 900	+ 22,300
Nizhni-Novgorod	+ 341,000	—	+ 700
Orenburg . .	+ 103,000	—	+ 12,700
Penza . .	+ 380,000	+ 3,200	+ 8,600
Samara . .	+ 180,000	— 200	+ 2,500
Saratov . .	+ 173,000	+ 18,500	+ 27,400
Simbirsk . .	+ 216,000	— 800	+ 6,900
Ufa . . .	+ 237,000	—	+ 400

The trade in live and slaughtered fowls is not very brisk. But the export of eggs is considerable from all the provinces save Astrakhan. In these provinces—although fowl-farming is not primarily of much importance,—owing to the surplus of grain available for the feeding of poultry, this branch of stock-raising has come to play a considerable part in the rural economy.

Surplus and Deficit of animal Fats and Tallow (Average of 1907–1909), and of Wool (Average of 1907–1909).

Province.	Animal Fats, in Poods.	Wool, in Poods.
Astrakhan . .	— 9,000	(+ 5,000)
Kazan . . .	— 310,000	— 8,000
Nizhni-Novgorod .	— 5,000	(+ 28,000)
Orenburg . .	+ 283,000	+ 241,000
Penza . . .	+ 5,000	— 89,000
Samara . . .	— 24,000	+ 12,000
Saratov . . .	— 16,000	+ 131,000
Simbirsk . .	+ 3,000	— 384,000
Ufa . . .	— 22,000	(— 12,000)

The export of animal fats and wool is considerable from Orenburg province; while Saratov province exports a notable quantity of wool.

The region as a whole distinguishes itself only in respect of the high production of grain. In respect of grain production, Nizhni-Novgorod and Astrakhan provinces stand at the two extremes. Nizhni-Novgorod province, where the grain pro-

duction is lowest, more closely resembles the other provinces as regards its industrial development. Astrakhan, on the other hand, is exceptionally productive in the agricultural respect, and is in a quite peculiar position as to the qualities of its soil.

The most prolific crop of corn stuffs is furnished by wheat, though in Kazan, and in Penza provinces rye constitutes the heaviest crop. Oats also occupy a prominent place among these corn products. We have already commented upon the dearth of barley. Connected with the vigorous grain production, we note that there is a considerable surplus of bran.

Potato growing and horticulture are of little significance throughout these provinces.

The area under consideration is one where stock-raising of the extensive type prevails. The fact that the railway transport statistics do not show a very notable export of large horned cattle and of sheep is explained by the prevailing custom of driving these beasts in droves to the distant market. Nevertheless we see that considerable quantities of beef, mutton, and pork are exported from the area.

SUPPLEMENTARY NOTES BY THE TRANSLATORS

1. METHODS OF IRRIGATION IN RUSSIA

RUSSIAN irrigation engineers usually classify irrigation under four heads: 1. lagoon irrigation; 2. direct irrigation; 3. mechanical irrigation; 4. irrigation with renewal of soil.

1. *Lagoon Irrigation.*—The Russian word is "liman" irrigation. "Liman" usually means "estuary"; but it is also applied to the large flat sheets of water known in England as "broads," and to such arms of the sea as that on which Venice is situated. On the whole, "lagoon" seems, in this connexion, the best English equivalent. Lagoon irrigation is the purposive flooding of an area with water. This area may be meadow land, or it may be destined for the sowing of wheat or some other grain. The soil of the temporary lagoon, saturated with water, retains enough moisture to render the crop practically independent of rainfall during the summer months. The lagoon is formed by damming the current of an adjacent stream; or, water may be conducted to the area to be flooded from a reservoir at a higher level. The flooded area has, of course, also to be embanked, to prevent a too rapid flowing away of the water. After two or three weeks, sluices are opened to allow the lagoon to empty itself. In hilly districts a terrace system may be employed in conjunction with lagoon irrigation, the same water being used successively at several different levels.

2. *Direct Irrigation.*—This is contrasted with lagoon irrigation because, in the latter, the water is not applied directly to the growing crops, but is used to saturate the soil before the crop is sown. In direct irrigation, the water from a natural head is conducted into fields by a system of furrows, or is applied to the growing crops in one or other of the ways familiar to western irrigators.

3. *Mechanical Irrigation.*—This is a variety of direct irrigation. It is separately classed because the head of water is not a natural one, but has to be gained by some form of mechanical power, ranging from the use of such simple and primitive devices as the shadouf and the noria or paternoster pump, to the use of water-raising windmills, and the employment of motor-driven force-pumps, etc. But once the head

of water has been gained, the method of applying the water is that of direct irrigation.

4. *Irrigation with Renewal of Soil.* — This is a variant of lagoon irrigation. The amount of solid matter suspended in the water is regarded as of almost equal importance to the fertility of the soil as the water which conveys the silt and moistens the ground. This is the characteristic type of irrigation in Egypt. It is also well illustrated by the warp-farming of the estuary of the Humber. Obviously the silt brought down in the spring freshets adds considerably to the value of lagoon irrigation in Russia.

The above descriptions will have shown that, in Russia, as elsewhere, there are only two fundamental types of irrigation : lagoon irrigation and direct irrigation. Lagoon irrigation corresponds to what western irrigation engineers term irrigation by flooding or inundation ; direct irrigation is substantially identical with continuous or sub-continuous irrigation by field channels.

The climatic and other natural conditions of the South East of Russia are, however, so distinctive, that the translators have thought it expedient to retain in the English text precise equivalents of the distinctive Russian terms.

2. RUSSIAN WEIGHTS AND MEASURES

Many of the statistical tables in the foregoing volume embody comparisons which are independent of the actual units of measurement to which the figures relate. In the case of the other tables, the translation of the items into English standards offered many difficulties, and would have considerably delayed the publication of the English version. The translators have, therefore, thought it expedient to retain the Russian weights and measures consistently throughout the work. The following information will facilitate conversion into more familiar quantities whenever desired.

pound . . = 0·9 of the English pound avoirdupois.
pood . . = 36·11 pounds avoirdupois.
Approximately, 3 poods = 1 cwt.
62 poods = 1 ton.
arshin . . = 28 inches.
sazhene . . = 7 feet.
verst . . = 3,500 feet.
Approximately, $\frac{2}{3}$ of an English mile, and only a little less than a kilometre.
square arshin . = 5·4 square feet.
square sazhene = 49 square feet.
square verst . = 0·44 square mile.
desyatina . = 2·7 acres.
Approximately, 237 desyatinas = 1 square mile. A desyatina is a little larger than the French *hectare* which is 2·47 acres.
cubic sazhene . = 343 cubic feet = 12·7 cubic yards.
As a measure of cut timber, 1 cubic sazhene is somewhat less than 3 cords.
rouble (gold standard) = 2*s.* 2*d.*
kopeck . . = $\frac{1}{100}$ of a rouble, and therefore approximately = 1 farthing.

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