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THE PARTICIPATION OF SOVIET GEOGRAPHERS IN THE WORK ON THE STALIN
PLAN FOR THE TRANSFORMATION OF NATURE

(From materials of the session of the Academic Board of the Geographic Institute of the AN USSR, devoted to questions of physical geography connected with field-protection plantings.)

At the beginning of February in the current year, a broadened session of the Academic Board was held in the Geographic Institute of the AN USSR. It was devoted to the questions of physical geography connected with the Stalin plan for the transformation of nature in the steppe and wooded steppe belts of the European territory of the USSR.

Nine scientific reports were read and discussed at the session.

A number of scientifically founded practical proposals were advanced by the participants in connection with the concrete measures for the implementation of the Stalin plan for transforming nature. These proposals were approved by the Academic Board.

In his introductory speech, devoted to the tasks of Soviet geography during the epoch of transition from socialism to communism, Academician A. A. Grigor'yev noted that the new stage of social development upon which our Fatherland had entered after the Great Patriotic War makes special demands upon science, including geography, as a result of the future tasks of economic and cultural development of our country.

An exceedingly high level of productive power in both industry and agriculture is necessary for the construction of a communist society. One of the prerequisites for the attainment of such a level in agriculture is the transformation^S of the geographic medium, thus assuring an ever-increasing fertility of the soil, high and reliable yields of agricultural crops, freed of dependence upon droughts and other catastrophic phenomena, and assuring as well a high productivity in animal husbandry. The success of all measures taken in this direction depends to a very great extent on the knowledge of the general regularities that govern the development of the geographic medium, since only such knowledge allows the accurate prediction of the results from the measures proposed for the transformation of the geographical medium at any given stage of that transformation. Thence derive the tasks that confront physical geography in solving the problem of transforming nature. They consist above all in an ever profounder study of the regularities of development of the geographic medium, in the working out of measures for its transformation, and in the accomplishment of these measures, with the purpose of introducing into practice the results of research in physical geography. The framework of this work, if we have the near future in mind, is not confined to the zones of steppe and wooded steppe, where a complex system of operations for the transformation of nature is already under way or will be initiated in the near future (creation of shelter belts and pond systems, introduction of grassland agriculture). Grandiose works as well are under way for the water supply and irrigation of huge territories in the steppe and desert zones of the USSR, for anchoring the drifting sands, afforesting the mountain slopes, etc. All of these measures only constitute the initial stages of the great Stalin plan for the transformation of nature in the USSR. There is no doubt that in the course of the further creative process of

calling this plan to life, the corresponding measures will take in all zones, all regions of the USSR, all the variegated types of geographic mediums which are represented upon our territory.

Thus the development of the economy during the epoch of transition from socialism to communism places before our physical geography complex and responsible tasks both in theory and in the introduction of that theory into practice. These demands do not take Soviet physical geography by surprise. Many years of work in studying the process of development of the geographic medium, and profound investigation by expeditions, have made it possible for the geographers to participate immediately in the practical operations connected with the transformation of nature, in steppe and wooded steppe, and also in desert and taiga regions.

The tasks of Soviet economic geography -- which is principally concerned with the study of the regularities in the distribution of productive forces and especially with the study of the economic development of the separate Republics and Rayons -- is considerably more complex during this stage in the development of the socialist economy than during the preceding Stalin Five-Year Plans. This is due both to the program of industrial development of the Soviet Union, which is steadily becoming more and more complicated, and to the immense changes which are to take place in agriculture as a result of the realization of the Stalin plan for the transformation of nature.

The implementation of this plan will be made possible by the changes in the geographic milieu, the increase in the productivity

of numerous agricultural crops, and their introduction into new regions. The first of these poses for economic geography the problem of the proper location of a whole series of branches of industry that are directly or indirectly connected with the processing of agricultural raw materials, while the second poses the problem of the rational redistribution of the agricultural crops.

A profounder study of the regularities that govern the location of socialist production is essential to the successful solution of all these responsible tasks. The scientific institutions can and must contribute their bit to this cause, especially on the questions of regional planning, location of industry, and location of agricultural crops.

In conclusion, Academician A. A. Grigor'yev pointed out that it was because of the correct theoretical orientation of Soviet science, founded as this orientation was, on the basis of dialectical and historical materialism, that our science was also of practical advantage, and itself, was developing upon a practical foundation. In emphasizing the harmfulness of the pseudoscientific constructions that dominated the science of the capitalistic countries, Academician Grigor'yev summoned all Soviet scientists to an irreconcilable struggle with the bourgeois theoretical constructions and the bourgeois views that were springing up in our science, which might act as a brake upon the accomplishment of the great plan of transforming nature.

He pointed out that the tasks he had enumerated were so sweeping and so variegated that a special session of the Academic

Board should be devoted to each of them. In this connection, although the Geographic Institute was doing more or less work in each of these directions, the session in question would consider only questions in the physical geography of shelter belts. The immediate participation of the Geographic Institute of the Academy of Sciences of the USSR in the research work in physical geography connected with the organization of state shelter belts, and in the introduction of the data of physical geography into production, i.e., in laying out the lines of state shelter belts of forest on the site, consisted in the following. The field work was being done by workers of the Institute on the following sites: (1) Penza - Kamensk; (2) Don River area; (3) Stalingrad -Cherkessk; (4) Volga area (Kamyshin - Stalingrad); Urals (from Mt. Vishnevaya to the Caspian Sea); in addition, two variant sites were being studied in Yergena Rayon. Workers of the Institute were participating in the investigation of the northern (Beloprudsk) and the southern (Dzhanybek and Yergen') nurseries and in the work of the scientific and technical conferences organized by the Ministry of Forest Economy USSR in Moscow, Voronezh, Saratov, Stalingrad, Ural'sk, and Chkalov, and also in a series of sessions of the Scientific and Technical Council of the Central Shelter Belt Administration in Moscow. Many technical projects for the establishment of government forest belts in various sections were being drawn by workers of institute, or were subject to their careful editing. Two exhibitions of scientific materials for the layout of government shelter belts had been organized in Moscow and Saratov, respectively.

Before commencement of the field work, summaries of the

materials (sketches) had been made for all shelter belt sites. Most of the work concerned study of the geomorphology and physical geography of the sites. In addition, on the Kamyshin-Stalingrad-Cherkessk site and on the Ural line (from Mt. Vishnevaya to Chkalov) zoogeographic studies were made of the activities, economic significance and distribution throughout the lands affected, of the birds and mammals useful or harmful to the forest plantings and the adjoining fields and steppes. This work produced new data of importance to forestry.

Together with this work, affecting the east and southeast of European USSR, the Geographic Institute also participated most actively in preparing the draft of the Government decree on shelter belts in the Central Asian republics.

1949 was the first year of the expanding operations of developing and accomplishing the great Stalin plan for the transformation of nature. In 1950 and in the following years still greater work stands before us, and for this reason it is exceedingly important, at the present time, to exchange our experience and discuss a series of urgent questions. And it is to this that the present session of the Academic Board of the Geographic Institute is devoted.

After the introductory speech of Academician A. A. Grigor'yev, a series of reports was heard.

The report of Ye. Ye. Fedorov, Corresponding Member of the Academy of Sciences USSR, and of L. A. Chubkov, Doctor of Geographic Sciences (The report is printed in full in this number of this jour-

nal.) "The Formation of Drought Weather Conditions and the Methods for their Transformation", considered the most important reasons for the formation of drought weather conditions on the plains of the European part of the USSR.

The report of G. D. Rikhter, Doctor of Geographic Sciences (The report is printed in full in this number of this journal.), entitled "Snow Cover and Shelter-Belt Forestry" pointed out the need for differential selection of the methods for regulating snow accumulation, taking account of the wide variation in the structure and properties of snow in the various climatic regions, and also according to the purpose of the operation (general increase in the accumulation of winter precipitation, distribution of moisture stocks in snow over a certain area, or regulating temperature conditions in the soil.)

Professor M. I. L'vovich (State Hydrological Institute) pointed out in his report "On the Transformation of the Hydrological Process under the Influence of the Dokuchayev-Kostychev-Vil'yams Complex", that in our socialist state action upon nature is being carried out on a scale never before seen.

The most grandiose measure of this order is the Stalin plan for the transformation of nature in the steppe and wooded steppe regions of the European part of the USSR.

The plan envisages a complex of measures worked out on the basis of the teachings of Dokuchayev, Kostychev and Vil'yams and the achievements of Michurin's agrobiological science. A radical transformation of nature in a direction assuring high and reliable

yields will be attained by these measures. It will be accompanied by a fundamental transformation of the hydrometeorological process as well. Simultaneously with the realization of the principal agricultural task, reorganization of the hydrological regime of rivers will also be achieved.

At the present time investigations into all aspects of the reorganization of the hydrometeorological process are being conducted. They are directed towards the solution of practical problems, of which the most important are: (a) development of statistical methods for the hydrometeorological planning of agricultural and forest melioration works with the object of further enhancing their effectiveness; (b) evaluation of the influence of measures of the Dokuchayev-Kostychev-Vil'yams complex on the hydrological regime of rivers.

The atmospheric processes act through the soil on the water conditions in the rivers. The soil is the intermediary between the climate (the meteorological elements) and the hydrological regime of rivers.

An important consequence follows from this thesis: change in the regime of rivers occurs not only under the influence of climatic transformation, but also as a result of artificial action upon the soil. This makes it clear how agriculture affects the development of the hydrological regime of rivers, for cultivation of the land and action upon the soil are carried out on very large scales, and in regions of insufficient moisture, reduce down to the accumulation of water in the soil.

In the last analysis, the development of the hydrological process is found to be intimately linked to the yield of crops, and the measures for obtaining high and reliable yields exert a profound influence on the transformation of the hydrological process.

Under the influence of the Dokuchayev-Kostychev-Vil'yams complex, the following transformations of the water balance sheet takes place:

$$p + \Delta p = s - \Delta s + F + \Delta l + u = \Delta u,$$

where Δp is the increase on the incoming side of the balance sheet caused by the increase of precipitation under the influence of the strengthening of the internal moisture turnover, the cessation of snow being blown away from the fields, and the reduction of evaporation from the snow cover; Δs is the retention of surface runoff by the structured soils under grassland rotations and the soils under the shelter belts; Δl is the gross expenditure of ground water in evaporation; and Δu is the increase in water fed to underground rivers.

Forest soil "possesses moisture-absorbing capacity in the highest degree, and is at the same time distinguished by permeability, similarly in the highest degree..." (V. R. Vil'yams, Pochvovedeniye. Zemledeliye s osnovami pochvovedeniya (Soil science. Agriculture with the Principles of Soil Science.) 5th ^{printing.} Moscow, SEL'KHOZGIS, 1946.)

The soils of shelter belts acquire the properties of forest soils; and therefore, even in small areas, if properly placed in relation to the relief (location of forest belts on the slopes, fol-

lowing a general horizontal direction) they are a powerful means of accumulating additional water for agricultural fields.

Under contemporary conditions the gross evaporation for the average agricultural field amounts to 340 millimeters, while the expenditure on transpiration is 112 millimeters, and the non-productive expenditure on evaporation, i.e., the evaporation from the soil, is 228 millimeters. Under the conditions of a transformed hydrological process, this ratio should be the following. The evaporation is 396 millimeters; the increase in evaporation is due to the increased amount of precipitation and to increased retention of surface runoff -- a very important item of gain, which yields about 60 millimeters of water, or over 600 cubic meters per hectare. Expenditure on transpiration is increased to 124 millimeters, or to more than double, while the nonproductive evaporation from the soil drops to 62 millimeters.

With the increase in the absolute amount of evaporation and the modification of the ratio between productive and non-productive evaporation, a favorable situation for the control of drought will be established. While under contemporary conditions the ratio of productive evaporation to the total evaporation amounts to roughly a third, that is, only a third of the moisture accumulated by the soil is productively expended on transpiration; under the conditions of a transformed hydrometeorological process, two thirds of the moisture will be expended on transpiration and only one third on unproductive evaporation.

It must of course, be understood that these figures cannot

be considered limiting, for further improvement of the ratio between productive and unproductive evaporation also lies in the hands of man, and further measures to enhance the effectiveness of shelter belts, together with subsequent advances in the methods of agricultural technology will probably lead to the value of transpiration approaching unity.

In examining the last element of the balance sheet -- the percolation of water into the depths to feed underground water -- courses -- the speaker came, after detailed analysis, to the conclusion that the thesis of G. N. Vysotskiy to the effect that a forest moistens the mountain and dries the plain is incorrect, and that if soil moisture increases under the conditions of steppe afforestation, the feed to ground water correspondingly increases.

Professor L'vovich then took up the question as to whether the hydrological process would change, with time, under the influence of the aggregate of measures for transforming nature; and he considered this question in the light of the illustration of the retention of surface runoff. With regard to the retention of surface runoff by the structured soils in the fields under grassland crop rotations, the problem was fairly simple to solve, for experience had shown that after the first complete cycle of crop rotations, i.e., in 8 - 10 years, according to the number of fields involved in the rotation scheme, the soils became structured and their permeability sharply enhanced. Consequently the retention of surface runoff by fields under crop rotation attains its full extent in 8 to 10 years after grassland rotation is first introduced.

The question of the retention of runoff by soils is somewhat more complex. On the basis of the calculations made, it may

be considered, within the limits of accuracy of all calculations, that in 20 to 25 years the water-retaining power of the shelter belt soils will have reached its full value.

In conclusion the speaker noted that the conclusions drawn with respect to the evaluation of the influence of the complex of measures on change of the hydrologic process were to be considered as first approximations, requiring elaboration and development. But they might serve as a scheme on the basis of which the development of further research was necessary.

M. I. Budyko, Senior Scientist of the Central Geophysical Observatory imeni A. I. Voyeykov, in his report "On the Hydrometeorological Effectiveness of Shelter Belt Afforestation," gave the results of the investigations into the mathematical physics of the influence of shelter belt afforestation on the water balance sheet of the soil.

Based on previously-established regularities in the mutual influence of water and thermal balance sheets on the surface of the dry land, the speaker constructed a system of equations that permit calculation of the change that would result from shelter belt afforestation in the amount of free (productive) moisture in the upper layers of the soil as compared with presently existing conditions.

In his report he presented as an illustration the data from the calculations of the changes in soil moisture of the upper layer of the soil for the mean conditions of Central and Eastern Ukraine. These calculations established that after

the completion of the plan for shelter belt afforestation, the quantity of free moisture in the upper layer of the soil in spring and at the beginning of summer would increase by not less than 30 - 40 percent which would assure a sharp increase in productivity. It followed from his analysis that this increase in soil moisture would be mainly due to the reduction in the surface runoff in the spring, reduction in the coefficient of turbulent exchange, and to a certain increase in the summer precipitation.

S. A. Sapozhnikov, Doctor of Geographic Sciences, (Central Geophysical Observatory imeni A. I. Voyeykov), in his report "Meteorological Investigations Applicable to the Problem of Transforming Nature in the Arid Regions of the USSR," gave a characterization of the work of the observatory that was connected with the Stalin plan for transforming nature. The GGO collective had been able to carry out, in a short space of time, a series of investigations into the meteorological effectiveness of the measures for controlling droughts and dry winds -- including the effectiveness of shelter belts in general and of the government shelter belts in particular -- and into the influence of the whole complex of measures on atmospheric precipitation.

A considerable amount of work was also done on the climatology of the regions of shelter belt afforestation in the European part of the USSR. The section for Agricultural Meteorology of the Central Forecasting Institute of the GIDROMETS~~SL~~UZHBA participated in this work.

On the basis of his experience in the 1949 operations, the

speaker expressed critical considerations concerning the inadequacies of the current appraisals of the meteorological effectiveness of the measures to combat drought and dry winds. At the same time he noted the tasks for further research at the specially organized hydrometeorological stations.

In the report of Professor B. A. Apollov (Institute of Oceanology of the Academy of Sciences USSR) "Influence of the Caspian Sea on the Climate of the Northern Coast of the Caspian" (Report will be printed in full in No 17 of this journal.), the important role of the Caspian Sea in humidifying the climate of its northern coast was emphasized. This influence is expressed with particular vigor by the increased precipitation during the winter.

Taking into account the serious influence towards mildness that the Caspian Sea exerts on the climate of the neighboring regions, as well as its important role in the national economy of the whole country, the speaker considered the time opportune for posing the question as to an active campaign against the continuous shallowing of the Caspian. The measures to regulate the surface runoff in connection with shelter belt afforestation will probably reduce the discharge of the rivers into the Caspian, which will undoubtedly be reflected in its water balance. For this reason the question as to the future water balance of the Caspian Sea must be posed at the same time as the general plan of measures for shelter belt afforestation.

The report of I. P. Gerasimov, corresponding member of the

Academy of Sciences USSR, "Ravines and Gorges of the Steppe Belt" (Report will be printed in full in No 17 of this journal.) was concerned with the problems of ravine formation and of measures to combat the active forms of ravine erosion. Based on the classical work of V. V. Dokuchayev, V. V. Masal'skiy, and A. P. Pavlov on the genetic link between ravines and gorges, and river valleys, the speaker connected the formation of most of the contemporary ravines of the steppe belt with a change in the surface runoff caused by the unorganized reclamation of new land, the destruction of the forests and the great amount of land being plowed up. Depending on the interrelation of the ancient gorge-valley forms and the modern ravine forms that have arisen on the bases of the former, three basic types of ravines should, in the opinion of the speaker, be distinguished: bottom, slide wall, and top -- and various methods of forest melioration should be set up for regions where ravines are prevalent. The general basis for local anti-ravine field-and-forest melioration works is the introduction of grassland agriculture, which regulates the surface runoff, and under the conditions of which the currently active ravine formation will be liquidated.

Ye. M. Lavrenko, corresponding member of the Academy of Sciences USSR, (Botanical Institute of the Academy of Sciences USSR), in his report "The Steppe Question at a *New* Stage" (Printed in full in this number of this journal.), analyzed the growing conditions of forests and the reasons for the present natural treelessness of the steppes in various subzones of the steppe zone.

A. N. Formozov, Doctor of Biological Sciences (Geographic Institute of the Academy of Sciences USSR) in his report (Printed in full in this number of this journal.), characterized the activity of animals which hindered or helped the work of establishing shelter belts.

A. G. Dorskach