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BULLETIN NO. 11

FOREST DESTRUCTION AND  
SLOPE DENUDATION IN THE  
PROVINCE OF SHANSI

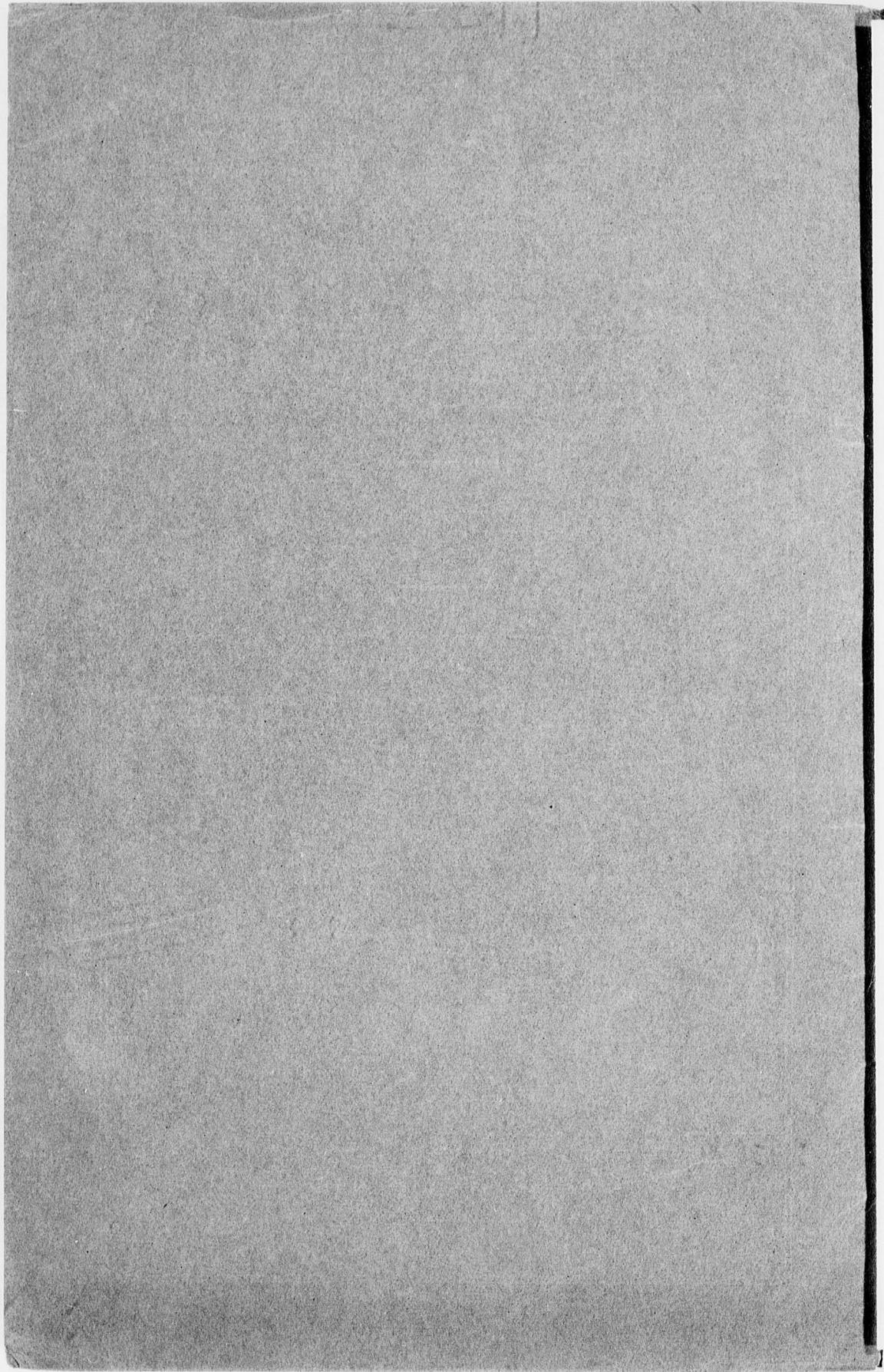
*by*

W. C. LOWDERMILK  
Department of Forestry

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FOREST DESTRUCTION AND SLOPE DENUDATION  
IN THE PROVINCE OF SHANSI

BY

W. C. LOWDERMILK

(Research Professor of Forestry University of Nanking)

Erosion has been a destructive process in Shansi for many centuries. Erosion is only indirectly related to the destruction of the former extensive forests, but is directly related to the cultivation of the slope lands for the production of food crops.

At numerous times naturalists, botanical explorers, foresters and trained observers have noted and decried the absence of forests on the mountains and hills of Central and Northern China. Norman Shaw (7) has clearly indicated the lamentable shortage of forests. Several of the Jesuit priests early noted the destruction of the forests, among whom were Armand David (2) and E. Huc (4). The latter more specifically describes the processes of soil degradation which was at work in Inner Mongolia previous to the year 1844. Sowerby (9) and Wilder (11) have described the same processes at work in the Tung Ling. Numerous writers of travel have noticed the thin soiled slopes and barren hills and mountains.

Shansi was chosen for the studies upon which this paper is based, because of the existence there of remnants of the former extensive forest cover. Adjacent to the forests were found denuded areas. The processes of converting a forest cover into denuded slopes could thus be studied in the very act. The region at the head waters of the Fen River was first selected as the site of these studies for the summer of 1924. During the summer of 1925, similar studies, in addition to special run-off studies, which will form the basis of another paper, were carried out in the three remnant forest areas of Shansi, namely, Ning-wu, at the head waters of the Fen River, also previously studied, Fan Shan, West Central Shansi, and Tsing-yuan Hsien, in which is located the Mien Shan forests, including some very interesting communal forests.

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The writer was ably assisted in these studies in the summer of 1924 by Professor C. O. Lee, associates in Forest Research, Messrs. T. I. Li and C. T. Ren, and by Mr. Tsiang Ying, a senior student in forestry; and in the summer of 1925 by Messrs. T. I. Li, C. T. Ren and H. L. Shen, associates in Forest Research, and by Mr. Chang Wen Tah, a senior student in forestry. During the latter part of the last summer, Mr. T. S. Tseh, Director of the First Forest Experiment Station of Shansi, visited our work at Fan Shan.

Governor Yen Hsi Shan, of Shansi, most cordially gave our party each summer valuable assistance and greatly expedited our work in many ways.

The Tai-yuan plain was suffering from a long drought when we reached Tai-yuan-Fu in 1924. The crops were dying for want of rain, even the wild grass had not started (July 3) and a famine was feared.

The rain clouds broke shortly after our arrival. The moisture which had been accumulating in the atmosphere, superheated by the roasting hills, came down in torrential volumes. The streams were suddenly overcharged with raging waters, heavily laden with mud and silt. The water supply so sorely needed for agricultural crops quickly ran off the steep barren slopes and brought floods and destruction in the place of the desired benefits of rain after drought. Despite the efforts made by the farmers to catch the flood waters for irrigation, most of them soon passed by and were gone. Dry weather in the fall months again made the conditions of the people serious and again threatened them with famine.

In the summer of 1925 the rains were more copious; likewise they were at times gentler than in 1924. Nevertheless the same phenomena of floods occurred as in the former year. The Fen River while in flood washed out the bridge in August on the motor road between Tai-yuan and Fen-chou. In many sections crops were drowned out, or the soil washed away.

From the evidences in stream beds such torrential run-off and destructive flooding are annual occurrences. The questions naturally arise as to whether this run-off has always been thus, and if there is any remedy for the present deplorable situation; for it renders food production over wide areas in the plain quite precarious. It is worth while, therefore, to examine the factors which contribute to the present regimen of run-off of the Shansi streams, as a preliminary to any scheme of flood control.

The stage is set in Shansi for the rapid development of torrents under certain conditions. The topography is steep and mountainous. The provincial surveys place the area of the plain land at 9 per cent. and the mountain land at 91 per cent. of the entire province (1). The slopes are generally steep. It is very probable that the most of the slope area has a gradient of over 25 per cent.

Likewise the rainfall is mostly convectional in character (3). That is, the clouds develop the cumulus form, due to ascending drafts of heated air whose moisture is condensed as the rising current reaches the altitude marking the dew point. The rains, therefore, usually come

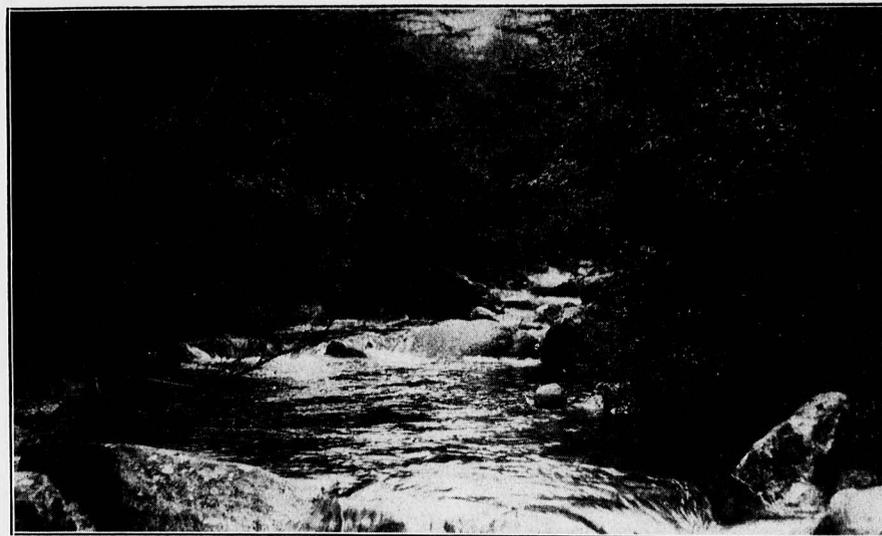


Fig. 1. A perennial clear stream flowing out of an undestroyed remnant of the original forest area. This stream scarcely showed the effects of the rains which caused raging torrents in the denuded valley under observation during five weeks (Summer 1924). Lo Yah Shan, W. Shansi.

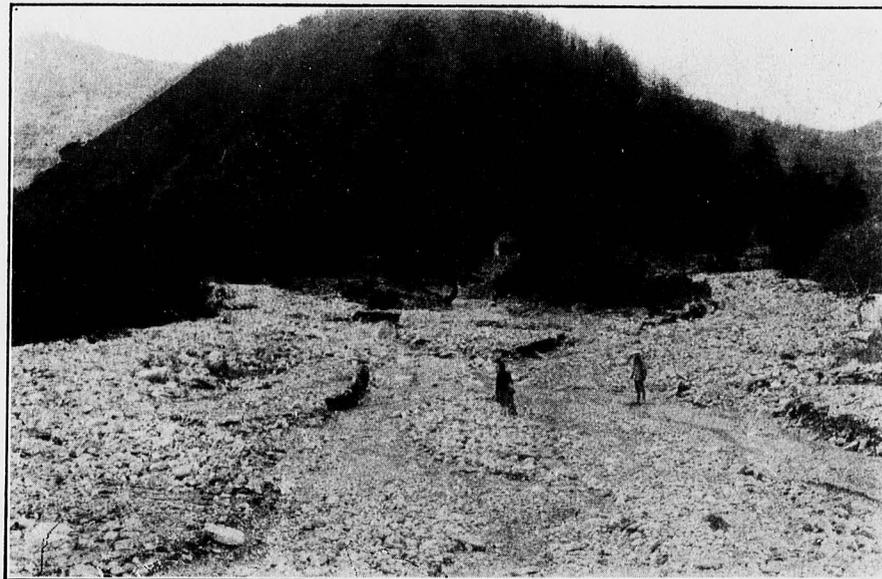


Fig. 2. Contrast this picture with Fig. 1. The slopes of the two converging valleys have been cleared and cultivated. A perennial stream which once flowed here has been converted into this torrential dry rocky bed within the past 40 years. Only when it rained hard did water flow down this valley, and then in a raging torrent. Tung Tsai, Ning-wu Fu District, W. Shansi.



Fig. 3. The forests in the vicinity of Lu Yah Shan are cut very wastefully; fully 15—25 per cent. of the volume of trees is left in high stumps, and wasted tops. More valuable timber is being wasted here than is being grown in the plantations near the plains.

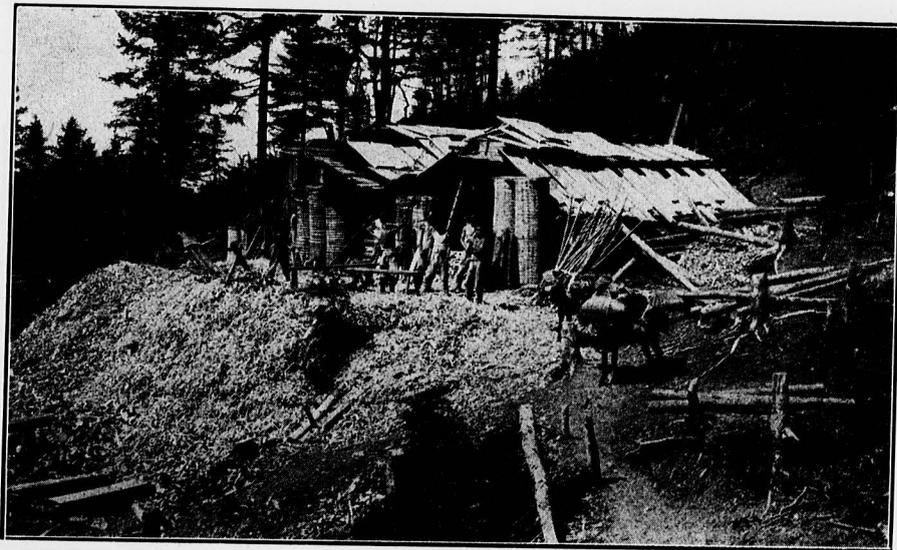


Fig. 4. Cutting and utilization is going on apace in the remaining stands of timber. Although the utilization is wasteful, this is not the process which brings about the loss of the forest cover.

## FOREST DESTRUCTION AND SLOPE DENUDATION

as thunder storm down-pours and occur most often in the latter half of the day, and rarely at night. Exceptions occur, but the precipitation is generally of the convective type, such as is characteristic of inland mountain regions.

During the two summers of 1924 and 1925 the rainfall was most often experienced as sudden down-pours. The latter summer, however, was marked by a few typical cyclonic rains, beginning with general sheet over-clouding and fine gentle rain, which lasted sometimes for several hours. Such rains were due to the occasional carrying over into Shansi of moisture-bearing cyclonic winds originating in the Pacific. The bulk of the rainfall, however, comes in the form of thunder showers and cloud bursts of high intensity.

Such is the stage setting in which man has been playing an important, and, perhaps, a somewhat villainous rôle for many centuries. (4) It is reasonable to conjecture that in early times the inhabitants of Shansi first began to clear away the forests from the level alluvial plains where the tilling of the soil for food crops was comparatively easy. As the population increased and the demands on the productivity of the soil grew, lands higher and higher up the slopes were cleared for cultivation. Whether this early clearing of the forest was done primarily for wood or for food production is not known. However, it is certain that as the needs of the increasing population approached the maximum productivity of the land, this clearing was done expressly to grow food crops. This went on until the forest and vegetative covers were cleared up to the mountain tops. Evidence of abandoned fields is found as far as the summit of Mien Shan and other high mountains. (Also see Smith, 8) Now only small remnants of the original vegetative cover can be found in the remotest and loftiest sections of the province, except where it is preserved by temple enclosures. Although timber is now increasing in value, it may be said that the dominant motive in removing the forests and clearing the land has been and in many sections still is to grow crops. The writer found logs rotting in the mountains of Shansi because of lack of transportation or profit in their removal. The land from which the logs were cut had been cleared and sown with oats.

The blind yielding to this demand for crop land has worked immeasurable misfortune to the people of Shansi. The studies in Shansi during the two summers, warrant the conclusion that this clearing of the slope lands for food production has set in motion certain processes which are inimical to the continued welfare of the commonwealth.

Man has no control over topography and little over the type of rainfall which descends on the land. He can, however, control the soil layer, and can, in mountainous areas, determine quite definitely what will become of it. This is not true to the same degree in level areas, for the controlling difference is the gradient of slope. Level lands may be cleared and cultivated for food production. In fact, this is the highest use to which such land may be put, except, perhaps, for residence. On slopes, however, where, according to measurements made in Shansi, the gradient exceeds 25 per cent., cultivated land is subjected to excessive wash and erosion during the sudden down-pours of summer rain. The deep fertile

soil layers may be entirely removed in this way after a few years : 3 to 10 according to experience in North Shansi and not exceeding 15 years on the more gentle slopes within this limit. The texture of the soil as well as the slope gradient are controlling factors in soil wash after the soils are prepared for crops, and therefore determine only the rapidity of the denudation. Cultivation of slopes makes denudation inevitable.

The complete story of the cutting of forests—the transport of some of the more valuable material, the clearing of the forest soil of stumps, roots, shrubs and other binding agencies, the planting with oats and potatoes, and the subsequent erosion, gulying, and development of torrents—was studied in the various stages in the highlands of Shansi during the summers of 1924 and 1925. These processes may be found at work at the present time in the highlands at the head waters of the Fen River, in Ning Wu Hsien. The ancient military camp of Tung Tsai (East Camp) is now the centre of the timber trade, which depends upon the logs, boards and poles which are packed out of the mountain valleys on mule back. In the vicinity of Tung Tsai are striking examples of various stages in the development of torrents. The torrent debouching into the main valley opposite Tung Tsai is a very typical example. It has come into being in the past 40 years due to the cultivation of the tributary watershed. The same processes and consequences are to be found around Lu Yah Shan on both sides of the divide between the Fen and Yellow River watersheds, and at many other points in these highlands. The unmistakable evidence of the onward march of this type of destruction may be found from Tsing Lo to Tung Tsai, a distance of 120 *li*, and throughout the mountains of Shansi.

The Fan Shan area of West Central Shansi presents two phases of these processes. Evidence is plentiful, in the form of abandoned fields on slopes, to show that the cultivation of the high slopes took place several decades ago. Few freshly denuded slopes exist now. But the remaining forest stands are now being rapidly cut. Particularly is this true of the holdings of a prominent family of Shansi. Plans are being made to rent as much as possible of this cut-over land to mountain farmers. The rocky nature of the soil may fortunately prevent its cultivation and favour the return of the forest, though more slowly than careful treatment would render possible. The timber of the Kuan Ti Shan area, a splendid forest cover of about 150 square *li*, has been sold to a match company which expects to use the poplar (*Populus sp.*) for match sticks and the birch (*Betula japonica* Sieb.) \* which occurs in splendid development as both red and white varieties, for match boxes. The spruce (*Picea meyeri* R. & W. *Wilsonii* Mast.) and larch (*Larix dahurica* var. *principis ruppertii* R. & W.) are sold as timber, being either floated in summer freshets or transported by camels during the winter to Kai-ssu at the edge of the Tai-yuan plain.

The south-eastern section of Shansi is an elevated and incised massif which drains southward directly into the Yellow River through its main

\* "Plant Identifications" by E. D. Merrill and Alfred Rehder.



Fig. 5. The timber supplies cut on the upper slopes are transported by mule to Tung Tsai. This primitive method of transport accounts for poor utilization and discrediting the value of a forest cover. Near Tung Tsai, Shansi.

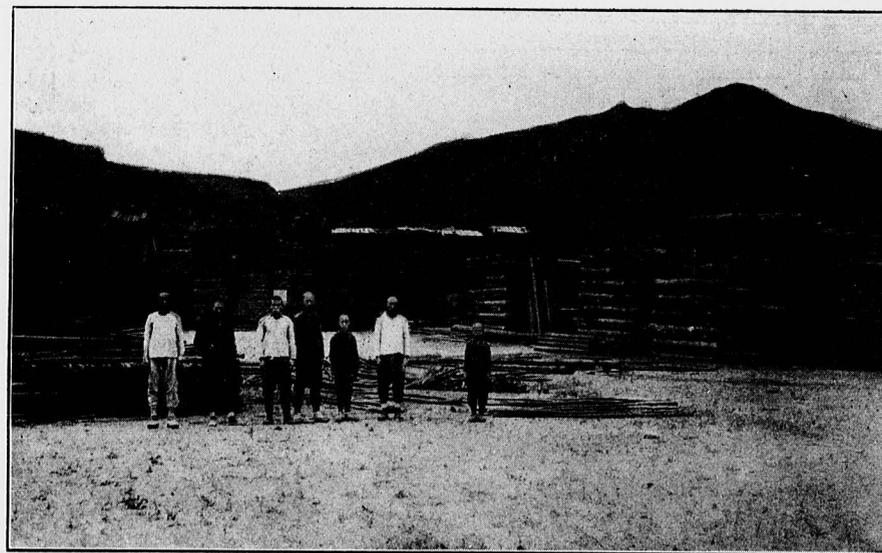


Fig. 6. One of the many lumber and timber yards in the town of Tung Tsai. Note on the hills beyond the few single spruce trees, which are testimonials to a former forest cover about Tung Tsai.

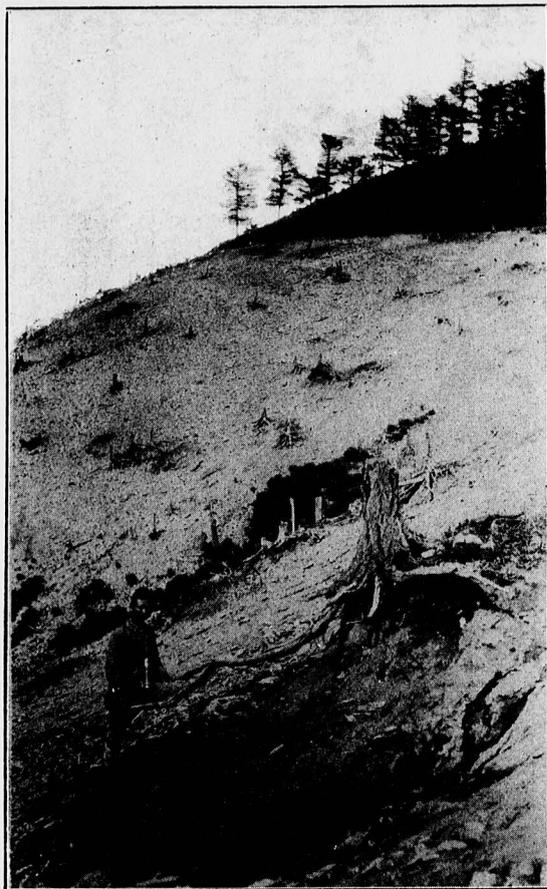


Fig. 8. When the soil is dug up, it is soon washed away by the summer rains. The steeper the slope, the more active is this process, until the mountain side is productive neither of forest nor field, but on the other hand becomes a menace to the valley below

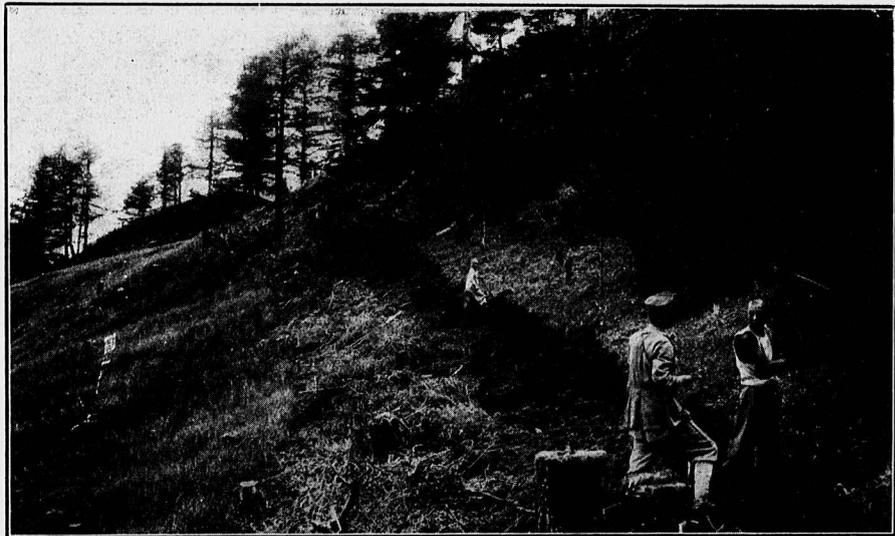


Fig. 7. The mountain farmer uses a long bladed pick which effectively loosens the soil from the binding and reinforcing effects of tree roots. This picture shows the advance on the forest cover. The field to the left consists of an oat crop; in the centre the farmers are shown digging up the forest soil for agriculture; to the right is the forest as yet intact.

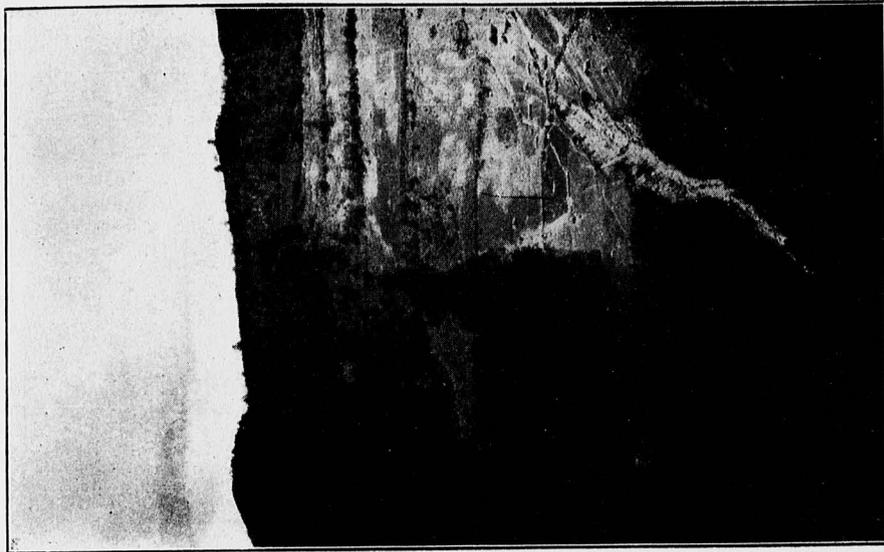


Fig. 10

Fig. 9. A general view of the process of denudation at work. The line of trees are property boundary trees, which by law and custom should be left to show the blaze marks. After the forest is cut off the land is dug up and sowed with oats. Thereupon the run-off washes away the humus soil, the more rapidly, the steeper the slope. Siao Si Ko, a valley near Tung Tsai, Shansi.

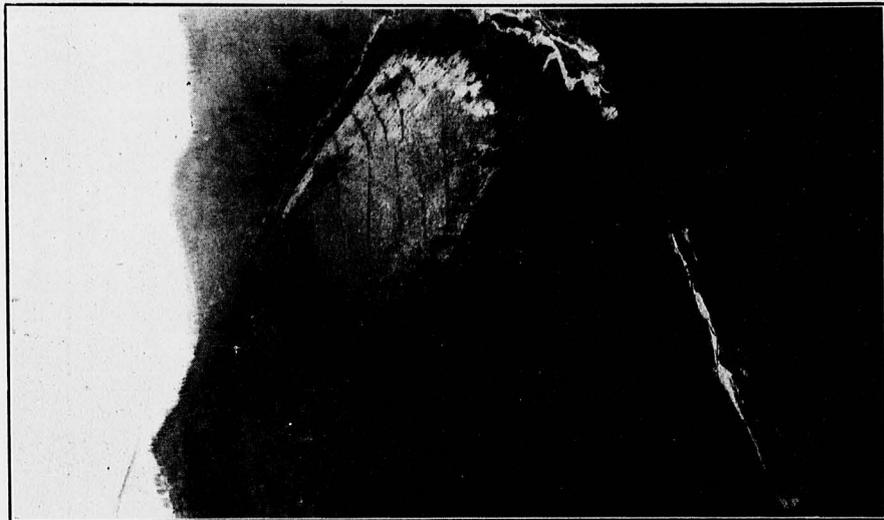


Fig. 10.

Deprived of a protective cover of forest growth the mountain slopes are defenseless before the rapid run-off from the summer showers and downpours. A torrent in the making.

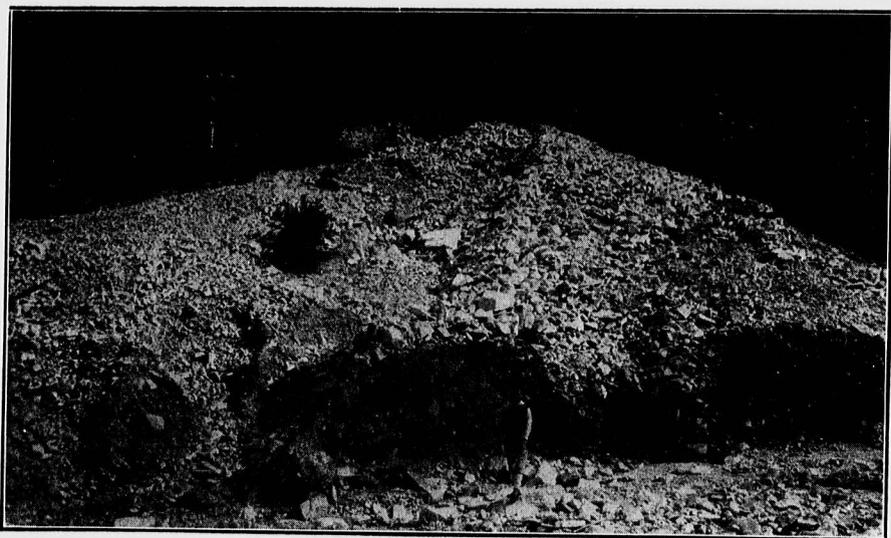


Fig. 11. Detail of a dump of an erosion gully as it debouches into another valley whose current carries the material further down. Note the effect of the larger stream. Near Tung Tsai, Shansi.



Fig. 12. A detail of an abandoned field which once was covered with forest. This tract had been under cultivation nine years. The black humus layer has disappeared and a brown rock filled soil remains, unproductive of oats or potatoes, or of forest growth. Near Tung Tsai, Shansi.

## FOREST DESTRUCTION AND SLOPE DENUDATION

stream, Tsin Shui. This region is carefully described by Smith, 1925. (8) This section represents a much older stage in the processes of clearing and cultivation. No large single area of forest is to be found, for cultivation has etched the entire landscape. A large part of the slope areas are thin soiled and rocky dry sites on which meagre and scattered pines have established themselves naturally. The restoration of the former cover through slow stages of plant succession are at work, and, if unmolested by sheep, goats and wood cutters, would in time build up a fertile vegetable soil in which trees and shrubs might thrive. Little hope of this exists, however, without an intelligent and energetic conservation policy.

Small forests are found at many points in this region and show the result of communal and temple effort at protecting trees for a continuous crop of material for temple and village house repairs. The Lin Kuen Shan communal forest is the most noteworthy. A most interesting stone tablet was found in the little temple of Tsong Tse Yu in Tsing-yuan Hsien. The inscribed record of 1887 recounts how the beautiful little pine forest on the opposite slope, with its heavy undergrowth of shrubs, had been protected since 1857, to supply the repairs for the temple and the village houses. This stone may be considered the charter stone of communal forests in Shansi. There are also the interesting clan forests which are managed by eleven villages. The white bark pine (*Pinus bungeana*) of Mien Shan, protected by the temple of Sun Lin Miao (8) is also a noteworthy remnant of forest.

The outstanding impression, after making a reconnaissance through most of the highlands of Shansi, and particularly in the three forest regions of the province, is that cultivation has at one time or another been applied to practically all the slopes of the land area.

Terracing has been resorted to as a safeguard against rapid erosion of the agricultural soils where the loess deposits exceed a thickness of ten or more feet. In a few areas of no great significance terraces are built up with stones to hold the soil wash of the thin rocky limestone slopes. But the area covered by terraces is deceptive to the traveller who follows the roads and trails of the valleys. From such routes the entire landscape appears to be terraced. In fact only the faces of the main slopes are terraced. The back country, comprising a much larger proportion of the land surface, is meagerly terraced or not at all. Perhaps not so much as 10 per cent. of the slopes are terraced. Terracing is a useful treatment of the slope lands if they are cultivated, otherwise the soils are soon washed away leaving the areas unproductive, or, as in the case of loess deposits, are so cut up with gullies as to render cultivation impossible.

Terracing in the loess appears to have originated as a result of the division of the slopes into narrow fields along the contours. Repeated plowing has, through soil-creep, lowered the upper edge and filled up the lower edge of the narrow fields one above the other. The net result has been to establish marked differences in elevation between two fields and the reduction of their gradients. The former slopes have thus been converted into terrace formation.

The process of denudation is considered for convenience in description in three different stages. The cutting of the forest is the first. The methods of cutting in the highlands of Shansi were a great surprise to the writer; for the waste in high stumps and the careless utilization of timber, which has such high value in the plains and which is so vital to the economy of the province, is practically criminal. Sowerby and Wilder make a similar observation for the Tung Ling (9) (11). The wasteful methods resemble those of America, where the diminishing supply of what was once considered unlimited timber is only beginning to be seriously felt. The costly method of transporting the logs from the mountains on mule back must be considered the primary contributing cause. This is necessitated by the absence of adequate roads. The owner of timber land generally considers that renting his mountain slopes to a farmer for growing oats is more profitable than retaining his land for growing trees. Thus, the forests are frequently cut off more rapidly than transportation can deliver the timber to the plains. Rotting logs and trees are common in the Ning Wu and Fan Shan regions. Thousands of cubic feet of fine timber lie rotting in these regions.

The succeeding stage of cultivation follows immediately upon the cutting of the trees. The forest soil contains the accumulated fertility of many decades; it is deep, black with humic material and is highly productive. Accordingly, it is eagerly sought for in order to grow food crops. The general experience, however, is that the first year's crop yield is not as high as the second, due to the incomplete decomposition of the raw humus material at first.

The soil is first broken with a long pick or mattock; since the network of shrub and tree roots makes turning with a plough impracticable. In succeeding years the land is ploughed with bullocks, unless the slope is too steep, in which case the long bladed mattock is used as long as the crops justify cultivation. The chief crop is oats, particularly with freshly cleared lands. Peas and potatoes are sown to lesser extent at the higher elevations, whereas millet, maize and flax constitute the crops at the lower elevations of the mountain areas.

The third stage is erosion, or soil wash, to a disastrous extent. As soon as the slope soils are deprived of the protecting layers of leaves and twigs, and the binding net-work of roots of shrubs and trees, dashing rain storms pack the outer soil surface and start tiny rivulets of flowing slime. (5) These accumulate and develop into rills which join together to form gullies. The run-off attains accelerated velocities as it accumulates and increases its transporting power by  $6\frac{1}{2}$  times the increase in velocity. The annual cultivation of the fields levels out the rills and fills up the small gullies and tends temporarily to check the development of larger gullies. Only a few years are needed so to remove the soil layer that the farmer can no longer afford to cultivate the slope fields. He, therefore, moves on to freshly cleared forest or shrub, and sets in motion the same processes of destructive erosion over an ever widening area. When the field is abandoned, the development of the gully is unhindered and goes on apace. The loss of the soil layer exposes residual rock fragments, which accumulate to form a rocky surface, whereby

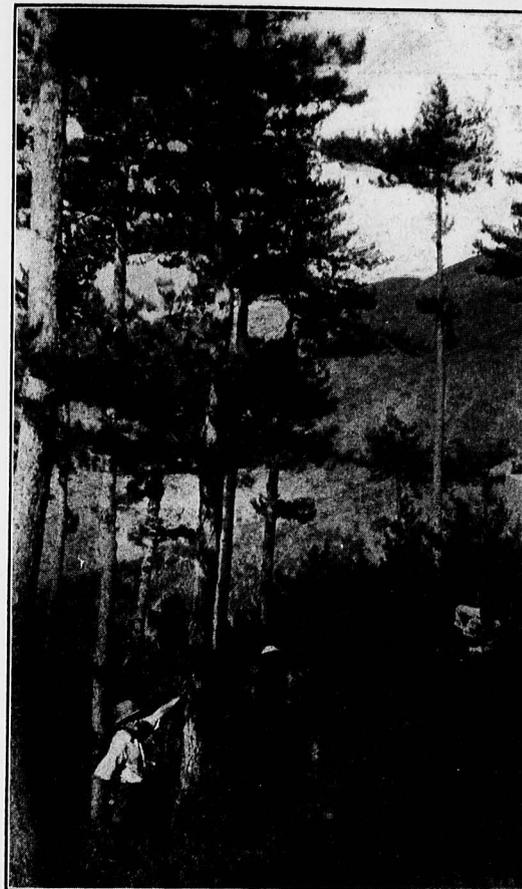


Fig 14. Detail of the Lian Ling Shan temple forest. Under the over story of pine a dense stand of young trees is coming up naturally. A certain amount of selective cutting is going on in this forest. Nature reproduction here is unmistakable evidence that the site is favourable to forest growth; an evidence of former extension of the original forest cover of Shansi and of potential forest growth in similar locations.

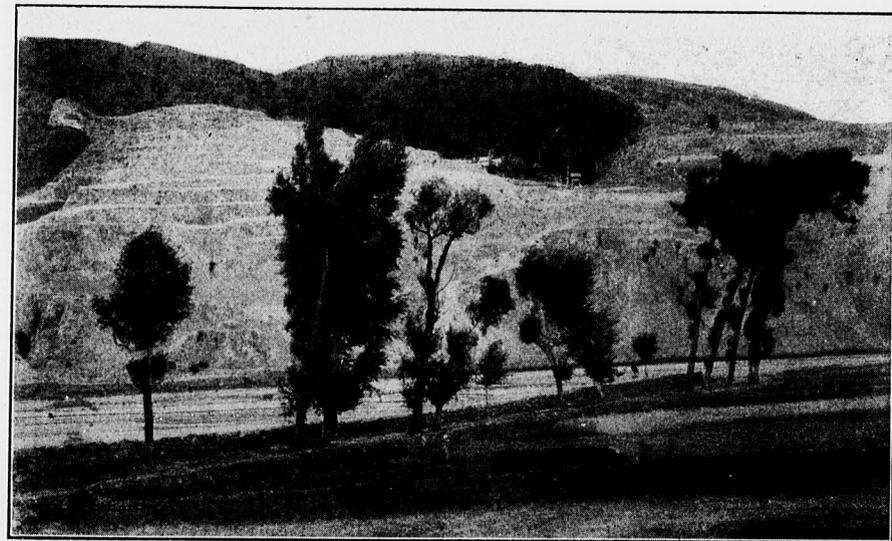


Fig. 13. A temple forest in the loess deposits opposite Tsing Lo, on the Fen Ho, Shansi. This is a splendid demonstration forest for the region. Note that where the forest is removed terracing is necessary to prevent rapid run-off, and to hold the moisture for agricultural crops.

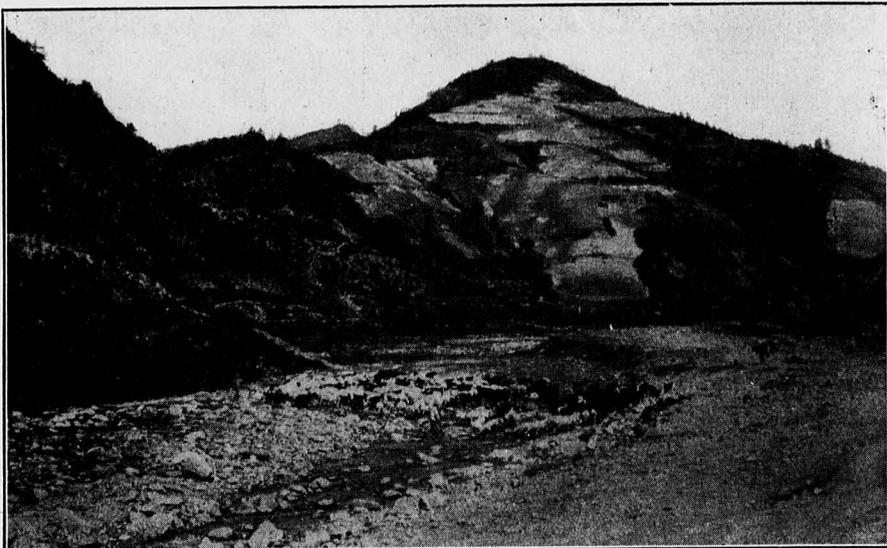


Fig. 15. After the forest is cut off and the fields are abandoned, sheep and goats are herded over the slopes effectively preventing the return of a protective cover. Near Tung Tsai, Shansi.

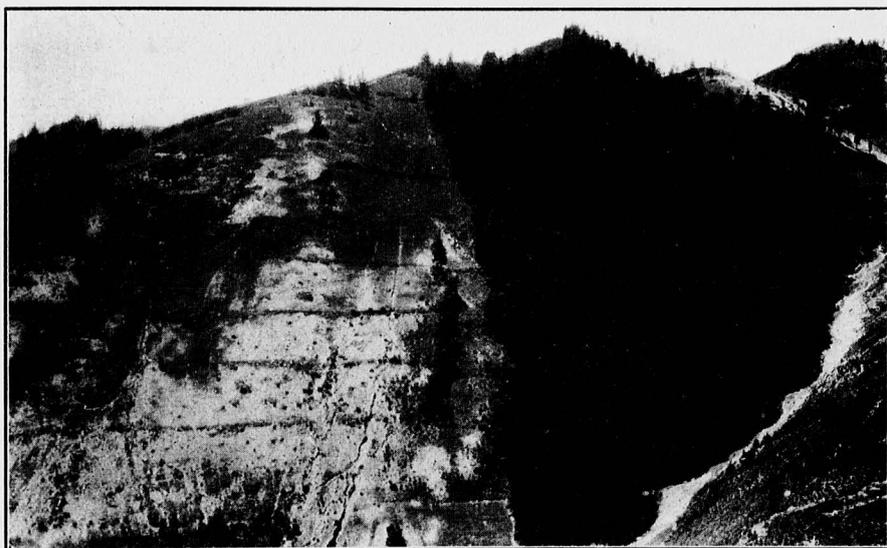


Fig. 16. "Contrast Valley" near Tung Tsai. Here is a remnant of the primeval forest cover, which has been cut over one or more times. The area to the left was at one time covered with a similar forest cover, which, however, was removed to permit the cultivation of the slope. The soils were washed away and gullying is in the process of rapid development.

## FOREST DESTRUCTION AND SLOPE DENUDATION

the rain waters are so much the more quickly converted into rills. The rills and gullies swell the run-off to proportions of powerful erosive force. Rocks are torn from the hillside, soil and rock debris are carried along in a raging torrent receiving accretions from all sides until great boulders are rushed along in the mad flood. It requires the contemplation of a torrent in full flood to appreciate the destructive power which is released in raging run-off waters of the steep valleys within the mountain areas.

These torrents carry and roll boulders and rocky debris along to cover and make sterile the agricultural fields in the valley of debouchment, and transport soil material in astonishing quantities, choking up the stream channels in the plains with troublesome silt. The slower currents of the streams in the plains are unable to keep in suspension these large quantities of silt, amounting to 22 per cent. by weight of the water in stream velocities of nearly 10 feet per second, and which the torrents in the steeper portions of the watershed tear off the mountain slopes. In consequence, the extra load is dropped, only to cause the disastrous flooding which is such a persistent occurrence in the plains of Shansi.

The result of these processes is the denudation of the soil layers from extensive areas of the slope region. The character of run-off is changed from perennial or prolonged flows to sudden floods, which leave the stream beds dry until the next heavy rain storm or the next rainy season. This marked alteration of stream flow has been going on within the memory of prominent inhabitants of the regions where the processes of denudation are now at work. A few perennial streams were found flowing out of untouched remnants of the forest cover, and some are in process of being changed to summer torrents. (Lu Yah Shan, Kwan Ti Shan).

If the denuded areas, however, should be left entirely to themselves, natural reclamation would in time heal the wounds so inconsiderately made by eager man. For a succession of hardy herbs and shrubs take possession of the denuded slopes as soon as cultivation ceases. In time a soil is built up and seeds from chance trees find lodgement, germinate, and in time will restore the forest in wide areas above an altitude estimated at between 5,000 and 5,500 feet. Below this level artificial reclamation may be required to assist the return of vegetation due to reduced supplies of soil moisture. But another agency is at work on the abandoned fields, preventing the working of natural forces in revegetation over extensive areas. Sheep and goats are driven almost daily over these areas; and both by their feeding and trampling, effectively prevent or at least hinder the return of the former shrub and forest cover.

If some eventuality causes the migration of the population from a mountain region, or if the population is heavily reduced in numbers, as was the case in Shansi during the great famine of 1877-9, opportunities are created for the natural restoration of the soil layers through the revegetation of the mountains. Apparently, this happened after the

great famine in parts of the Fen Ho, Wen-shui and Tsin-shui watersheds. There is now a general movement of farmers back into the mountains of Shansi to clear and cultivate shrub and forest lands. Numerous evidences of this tendency are to be found in the rebuilding of partially ruined villages, in the formation of mountain land companies, and in the rapid buying up of mountain lands. Our party encountered several villages peopled with former inhabitants of the Tai-yuan plain who had within the past ten years established themselves in the mountains near Fan Shan.

The significance of these processes must rest on the extent of the original forest and shrub cover of Shansi. Evidence of a former extensive cover of forest and shrubs is patent. Sowerby suggests a strip of forests from the Tung Ling across the highlands in a southwesterly direction to the great central highland forests of Asia (10). Huc, even as late as 1844, describes forest stands in Inner Mongolia which no longer exist (4). Hsien histories of Ning Wu and others include references to more extensive forest areas. Perhaps the most trustworthy indications are the existing temple forests. To include all areas of similar altitude, or higher, with the existing temple forests would in itself indicate an extensive forest cover for Shansi (8).

The clearing of the natural vegetation and the cultivation of the slopes of Shansi have been going on at an increasing rate until only remnants and spots of the former vegetation are now left. These are found in the quite well distributed temple forests and in the remnant forests in the higher and more inaccessible parts of the mountains. In some of these areas ideal forest conditions exist. It would seem that such areas should now be made into provincial forests and carefully preserved as specimens of true forest conditions. The eager search for land to produce food has, however, taken precedence in the past and continues to do so. It appears that the cultivation of the slope lands has, in the last analysis, effectively reduced rather than increased the total food production.

The problem of forest restoration on the slopes of Shansi involves many factors. Watershed protection in its broad sense is the most urgent. For the need of a regular water supply supercedes an additional wood supply in Shansi. Watershed protection comprises the preservation of forest conditions, where they now exist, by controlled cutting, the regulation of slope farming and the management of the ranges for grazing. Range management is perhaps one of the most urgent requirements as well as difficult. Many seriously over-grazed areas were encountered in quite extensive travels into the back country. Tree planting is badly needed in some sections, but the most effective method of restoring a cover sufficient to prevent erosion and to check the development of torrents is to give the native hardy vegetation an opportunity to develop and to render this artificial assistance at altitudes below 5,500 feet. Works of torrent correction and erosion prevention are needed in the gullies and torrents where conditions have developed to serious proportions.



Fig. 17. Tung Tsai, Shansi. A view of the torrent bed draining "Contrast Valley." Note the size of the stones which are handled by the torrential flow.

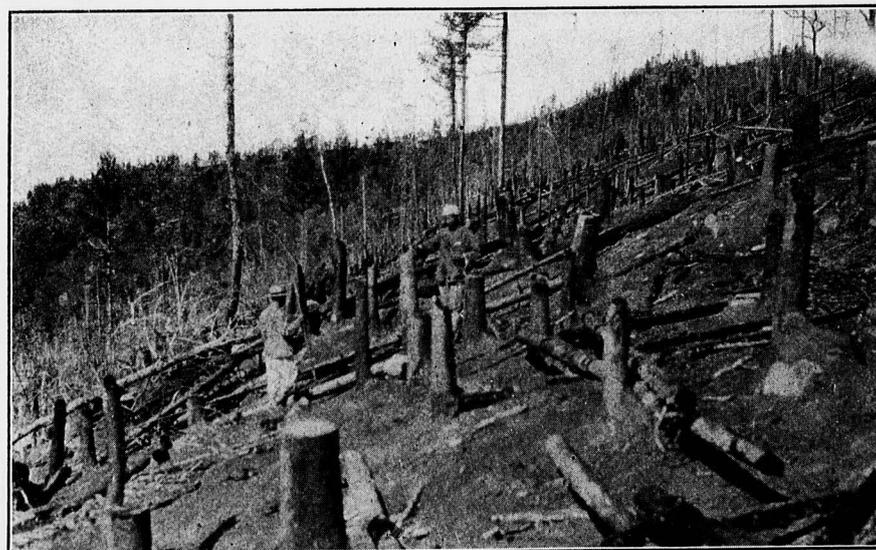


Fig. 18. Near Kwan Ti Shan. The result of an accidental slash fire in a cutting of a private forest, the property of a prominent family of Shansi. Note the high stumps. It is reported that \$10,000 worth of felled timber was burned in this fire, which was due to carelessness.

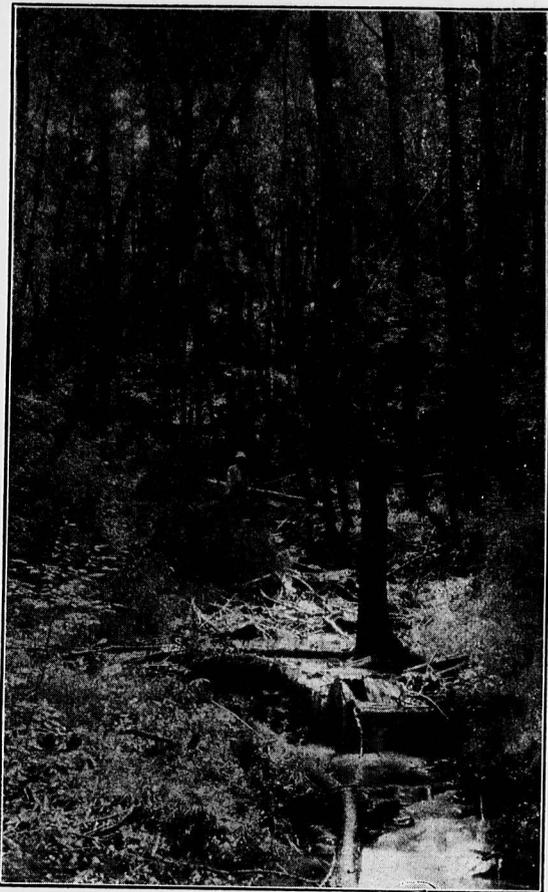


Fig. 19. Kwan Ti Shan.  
True forest conditions  
where streams are per-  
ennial and clear and  
lightly reflect the varia-  
tions in rainfall.

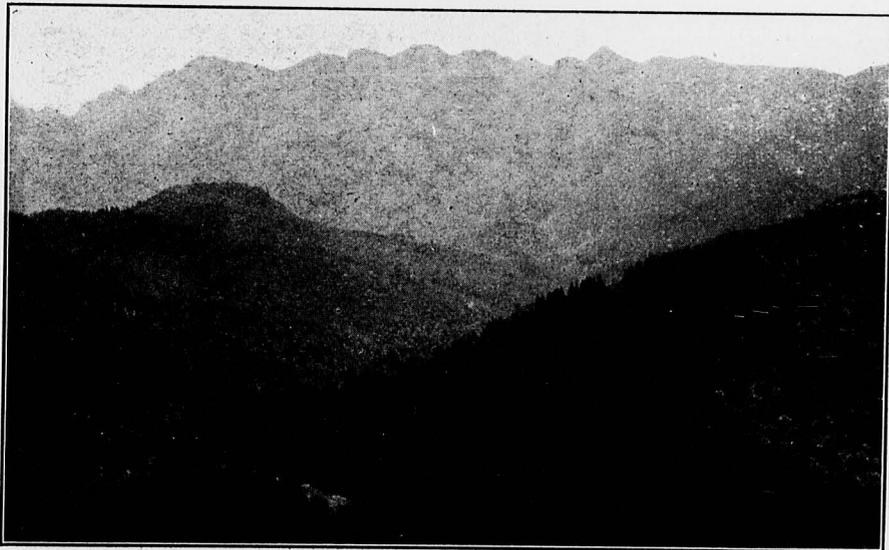


Fig. 20. Kwan Ti Shan, Shansi. One of the largest remnants of the original forest cover of Shansi, being about 150 square li. The stand in the foreground is pure larch (*Larix dahurica*). The hard wood stands represent a succession of *Populus sp.* and *Betulus sp.*, which have followed cutting of larch and spruce.

## FOREST DESTRUCTION AND SLOPE DENUDATION

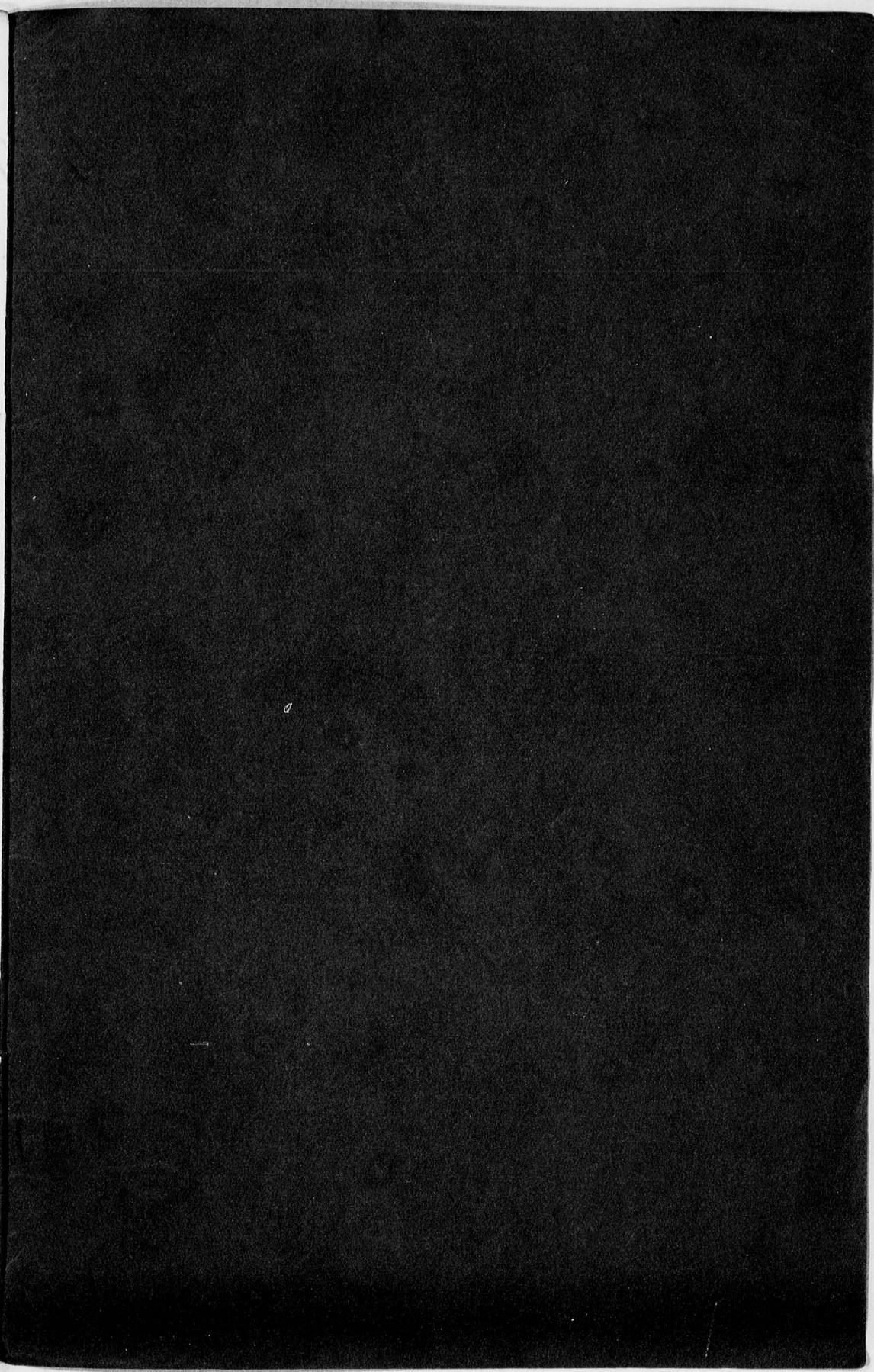
### SUMMARY :

With steep topography and a convectional type of rainfall, Shansi is a stage admirably set for the play of processes of excessive erosion and denudation. The condition of the soil layer is the only factor within the effective control of the inhabitants. Exposing the soils on the slopes to the wash of torrential rains has brought about immeasurable ills to the inhabitants through loss of productive soil resources, in the irregular regimen of run-off and in the reduction of the aggregate food supply. Forest destruction appears in Shansi to have been only a preliminary stage of a more disastrous process of slope cultivation, which is considered essentially responsible for the unfortunate conditions of the mountain lands and river plains.

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**EROSION AND FLOODS ALONG  
THE YELLOW RIVER**

By W. C. LOWDERMILK

College of Agriculture and Forestry  
Nanking University  
Nanking, China

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Reprinted from the China Weekly Review  
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Shanghai, China

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## Erosion and Floods Along the Yellow River

BY W. C. LOWDERMILK

**T**HE flood problem of the Yellow River and of other streams of North China has attracted the attention of conservationists throughout the world. It is an ever present source of distress to the population affected and of anxiety to statesmen and to those concerned with ameliorating the precarious lot of the populous flood plains. The reduction or prevention of flood damage, therefore, calls incessantly for accomplishment. Studies have been made and methods outlined by prominent engineers for controlling the flood waters of the Yellow River, its tributaries and of the lesser streams of North China. Any specific contribution to the solution has its place. This work of flood control is urgent and waits on constructive action.

North China is afflicted by a succession in rhythmic tempo of droughts and floods. The gazeteers of any typical district contains a record of the repetition of flood and drought each of which calamity carries with it distress or famine. Moreover it is a singularly noteworthy fact that the flood damage in North China is incomparably greater and more notorious than in central or southern China, yet the Yellow River watershed receives, according to estimates based on available precipitation records, less than 20 inches of rainfall per annum. This amount is  $1/2$  to  $1/4$  less than the rainfall of central and southern China. The Yangtse River watershed receives an average of over 40 inches; but the flood damage is insignificant in comparison. The greatest flood damage does not occur in the region of greatest rainfall but in the region of least rainfall in China. Factors other than the volume of water are responsible for the flooding.

Unlike other great watersheds of China, that of the Yellow River lies in the famous loess deposits. The loess blanket has not been accurately surveyed but is known to cover hundreds of thousands of square miles. The cover varies in depth from a few inches to over a thousand feet. The average depth may be several hundred feet. The wind blown material comprising the loess deposits is very finely divided. It may be said to be pre-pulverized. In situ it is friable and possesses a vertical cleavage. When the loess is exposed to the action of running water it melts away into it and rapidly loads the current to its transporting capacity. Only where the surface is protected by a vegetative cover is this tendency to rapid erosion checked.

### Dikes Alone Can't Prevent Floods

The floods of North China are intimately related to the erosion of the extensive loess deposits. The building of dikes alone is not sufficient to bring about a lasting solution to the control of floods. Certain elements enter into the situation in North China which should not be overlooked. Something must be done to reduce the erosion of the loess uplands along with dike construction in the plains of deposition.

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As a part of the Permanent Famine Prevention Project undertaken by the University of Nanking the writer is engaged in making investigations of the relationships of forestry to floods and famines and in working out ways whereby tree planting and forest management may contribute to the control of floods and to the industrial and economic improvement of the populations in regions of high famine hazard. One project of these investigations has for its object a study of the run-off conditions of the Yellow River watershed. The writer has recently returned from a two thousand mile trip through Honan, Shensi and Shansi for the purpose of studying watershed cover and erosion conditions. As an outcome of negotiations last year it proved a happy circumstance that a joint survey could be made by O. J. Todd, engineer representative of the International Famine Relief Commission and the writer as a forester. This Mr. Todd was able to do in conjunction with his investigation of the Weipeh irrigation project of Shensi and certain road projects. This trip afforded excellent opportunities to study irrigation, road building, prevention of erosion and afforestation projects jointly.

The portion of the trip wherein observations and studies of run off and erosion conditions were made, extended from the railhead of the Lung Hai Railroad, to Sianfu, two days of which journey were made by boat on the Yellow River to Tungkwan. Tungkwan is the Gibraltar of northern China, and has been important in history. From Sianfu trips were made into the Weipeh district to investigate the proposed irrigation project and into the mountains to the south of Sianfu to investigate forest resources. Finally our route lay in a due northerly direction from Sianfu for over 300 miles where travel was made on foot and by mule through San Yuan, Sochwan, Yenfanfu and other lesser towns. We left Suiteh on our left and crossed over the high land to the Yellow River at San Chow. Here the crossing was made into the province of Shansi. We reached the Fenchow Yellow River Red Cross famine road, 20 li from its western and river terminus. The route lay along this road to Fenchowfu, thence to Taiyuenfu and return.

#### Cause of Floods

It was along the route through Shensi chiefly that studies and observations of the erosion in the loess deposits were made. Any one who will take the trouble to travel or ride over sufficient of the watershed in the loess country will come to understand one of the primary causes of the extensive flooding in the plains. The vast deposits of loess are traversed throughout by this route. In North Shensi the thickness of the deposits averages perhaps as much as 400 feet, and is like an enormous buff-yellow blanket spread over a pre-eroded landscape. The loess deposit is an impressive phenomenon. Geologically it appears very probable that formerly the loess region was more or less a level plain and rolling hills. But perhaps even more impressive are the evidences of erosion in the loess cover. The rainfall run-off from the region has carved and sculptured the former loess plains into a maze and labyrinth of enormous gullies, up to 600 feet deep. The excavation of its valley by the Yellow River has produced a considerable differential in elevation of plain and river. When the protective vegetative cover therefore, was removed, the loess material was exposed to active and rapid erosion.

This erosion is not restricted to isolated areas. It affects thousands of square miles. It is an outstanding phenomenon of the region. Numerous times along the route, ocular estimates were made of the percentages of the landscape occupied by steep walled gullies. Fully fifty per cent

of North Shensi which could be observed from the trails, is estimated to be occupied by erosion gullies. Sufficient of the loess country was seen to justify the belief that the same or a similar type of gullying must exist over most of the loess country.

In many sections of north Shensi gullying has proceeded so far that the only available location for the trails or mule paths is over the highest peaks and saddles. While this feature inflicted some steep climbing and descents, yet it afforded unparalleled views. The vertical cleavage in the loess material favors the formation of perpendicular and precipitous gully walls. Very frequently one had an indescribable sensation, while astride a pack mule, in passing along the very edge of a gully whose walls dropped sheer downward from almost underfoot, one hundred, two or even three hundred feet to the gully bottom. As the gullies excavate backward, they force the trails into more (circuitous) routes. One spends, at times, a good portion of the day going around the heads of the immense gully washes. In numerous places where the trail lay along the crest of a divide, gullies laid out backward into the ridge, toward each other, until only a thin wall of loess remained to separate them. The trail of necessity passed over this thin partition wall. Several of these narrow points were measured; one was as narrow as 3 feet; another was 4½ feet at its narrowest width. In the latter instance, the wall on one side dropped down sheer 100 feet to the talus slope which inclined away to the gully floor. On the other side the wall likewise dropped down an almost sheer 300 feet then inclined away in the talus slope. When one travels for weeks, averaging 70 li per day through such evidences of erosion, he can not escape the impression of its magnitude.

#### Silt Raises River Beds

It is this erosion which through the agency of the rapid run-off of the heavy summer rains that charges the flood water with unbelievable quantities of silt. The streams come down out of loess hills as fluid mud. The rapid flow of the upland torrents increase their transporting power to herculean amounts. In accordance with the well known hydraulic law the increase in transporting power is accelerated over fifty times when the current flow is doubled. These torrents come heavily laden, as fluid mud, to the plain, where the profile of the stream flattens out. The speed of the current thereupon is checked and reduced. The transporting power of the flowing water is reduced in a corresponding inverse ratio. Great quantities of silt, are therefore, dumped on the plain to choke up natural and artificial channels. The silt by its quick settling qualities (see John R. Freeman's report, Flood Problems in China) has progressively raised the beds of the streams above the plains. This characteristic has notoriously made the control of floods with dikes expensive and difficult. The silt is responsible for the streams' breaking from their barriers. The silt burden, accordingly has been primarily, rather than the volume of water, responsible for the flood problems in North China.

From studies of the content of silt in flood waters made by John R. Freeman, Director of the Grand Canal Improvement Investigations, the following striking results are taken. (See Flood Problems in China, by John R. Freeman, page 1148). The average flood volume for a period of 40 days (1919) was 150,000 second feet. The flood water contained an average of 6.5 per cent by weight or 4.5 per cent by volume of silt. The maximum load ran up to 9 and 10 per cent by weight. Taking 5 per cent as an average by volume the total amount that a single flood brings down is incredible. Freeman hesitates to believe that transport of silt in such quantities has been going on for many centuries. The shore line of the delta, as Freeman points out, has not proceeded seaward rapidly enough to account for such loads of silt.

More study is ostensibly needed of this problem but the writer's opinion is in agreement, that the movement of silt in the Yellow River flood waters as well as in the usual flow has not gone on at this rate for many centuries. It is his belief, on the other hand, that the erosion has been accelerated and to a dangerous extent in the past few centuries. Some reasons for this will be considered below.

#### Yellow River Restless

The record of the wanderings of the Yellow River over its delta plain as cited in the Freeman Report from the works of an historian of 200 years ago is in point. The intervals between the major breaks of the river are progressively shorter in time from about 2000 B. C. as the following table derived from the historical record shows.

#### Changes in Courses of the Yellow River

No.	Periods in which River held its course in years.	Intervals in years
1	2278 B. C. — 602 B. C.	1676
2	602 B. C. — 11 A. D.	613
3	11 A. D. — 893	882
4	893 — 1048	<del>155</del>
5	1048 — 1194	150 146
6	1194 — 1289	95
7	1289 — 1324	35
8	1324 — 1852	528
9	1852 — to date	(72)

Certain allowances must be made for minor omissions and for some inaccuracy in the ancient record. Nevertheless if the record is correct, it is apparent that some agency has caused the river to become progressively more restless in its bed. Excavation of the upper channel is not sufficient to account for it. A measure of excavation is had in the ancient irrigation system of the Weipoh, where the canal inlet of the pre-Han dynasty period is left high and dry fully fifty feet by the King River. The excavation of this tributary not far from the Yellow River may be taken as an approximate measure of excavation by the Yellow River itself.

#### Lack of Trees Cause of Erosion

It is to be noted in the table that from 1324-1852 A. D. the river was held in its course for 528 years. This was done by artificial works which checked the natural tendency of breaking away from its ever lifting bed. The fact rather emphasizes this tendency. For it became well nigh impossible to hold the river longer in its elevated course. More study is needed to explain the increasing restlessness of the river, but it is the writer's belief that this is an evidence of the results of accelerated erosion of the loess uplands and further that this erosion has coincided with the expansive denudation by a progressively increasing population. Marco Polo describes in his travels, three days out of Sianfu, great forests filled with wolves, "lions" and wild beasts. This forest is no longer to be seen. As the population expanded from the alluvial plains, which nourished the centers of early Chinese civilization, the forests and vegetative cover was cut or burned from the uplands, step by step until the only forests remaining now are pushed back to almost inaccessible regions of the mountains. The uplands have accordingly been exposed at the same pace to the erosive action of the monsoonal summer rains. Other changes very likely came about as a result of this general deforestation, but the result of most concern to the present and future generations is the abnormal and accelerated erosion.

Erosion on the present scale in the loess hill lands jeopardizes the permanence of flood-control works. It is impossible to believe that the slower waters of the plains even when confined within dikes can continuously transport to the sea the tremendous burdens of silt brought down out of the hills in the summer torrents. Any large scale flood prevention project must take into account this excessive erosion in the loess hills,—it must provide for reducing the erosion as well as for the training of the rivers.

On this trip through Shensi, the writer studied the possibility of reducing the erosion in the loess hills. The checking of excessive erosion is deemed possible. Furthermore the works of prevention should pay for themselves. Nature has pointed out the way for checking and reducing the excessive erosion. It only requires that the methods indicated by nature be applied, intelligently and on a comprehensive scale.

Nature's method preventing of excessive erosion deserves a short notice. The expression "excessive erosion" is here meant to describe the removal of the soil at such a rate that vegetation is not given time to find lodgement on and clothe the slopes. A certain amount of erosion must take place where excess rainfall runs off into streams thence to the sea; but normal erosion may go on without the destruction of the vegetative cover. Where given an opportunity the persistence of vegetative life tends to reclaim the open wounds in the earth's soil cover.

#### Tree Planting Imperative

The gully wash is the unit of excessive erosion; it is the means by which the run off waters are charged with the excessive silt burden. A study of the gully therefore is necessary to understand how the erosion proceeds and how it may be checked. The gully in the loess soil is characteristically steep walled by reason of the natural vertical cleavage of the loess deposits. The head of the gully is generally, precipitous or boxed resembling a "boxed canyon." The run off is confined between the upright or steep walls however, and the talus slopes, or "toes." The run-off currents first attack and wash away these toe-or talus slopes. Then the current undermines the wall, which parts along the vertical cleavages and drops or caves in, and thereby furnishes a dump of fine material which melts away like sugar in the charging current. The critical point in this process is the talus slope; if this can be fixed, the situation is in hand.

In those parts of Shensi where the population is sparse and where the vegetative and tree cover is not constantly removed, it was noted that the talus slopes were covered by herbs and trees. The raw soil was not exposed, and run off waters could not be overcharged with silt. The remedy, is simple and lies in fixing the talus slopes of the gully washes. The talus slope is the key to the situation.

That the talus slope may be fixed artificially is proved by the fact that it is done in a few cases in north Shensi by the planting of willows. It is very unlikely that the farmers planted the willows to stop erosion, but rather to produce wood material. But the production of needful wood material in these instances had the further beneficent result of stopping excessive erosion. The method which should be put into practice is stated as follows: Plant trees of several species in the bottoms of the gullies and on the talus slopes. Willows and poplars, should be used very extensively. Also such species as the black locust and the native catalpa, both of which have the faculty of extensively reproducing

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themselves naturally by root suckers, are especially advocated. It is not enough to plant a row of trees but to plant sufficient to produce a dense stand. The slogan should be: Fill the gullies with trees rather than plant the hills with trees.

Other advantages of this remedial measure exist. North China is afflicted with a long dry winter and spring which makes the starting of trees on the uplands very difficult or impossible if they are not watered for two or three years, an expensive proposition. But the bottoms of the gullies are near the water table and are generally moist. Trees are easily and cheaply started in them. Furthermore the growth of the trees in the gullies is much more rapid than on the tops of the hills. Wood is produced more rapidly per unit area. And the more level portions of the uplands are sown to wheat, which is managed as a dry-farming crop. Forests in this case should not supplant wheat fields. The gullies are not only a hazard but are waste land areas and comprise fully fifty per cent of the land surface. The planting of the gullies with trees fortunately may become both self supporting and a beneficent erosion control measure.

Every effort is needed to push forward this type of afforestation in the loess lands. Each provincial famine committee of the loess provinces would do well to include this type of erosion prevention as a famine work project along with the irrigation and road work projects. There need not be a conflict, for the afforestation projects would call principally on the labor supply of the more rural sections. Villages should be held responsible for checking erosion within their precincts by planting up the gullies therein.

These gully forests or plantations should ipso facto become village, communal or municipal forests, administered, guarded and managed by the villages according to simple rules in forest management for the benefit and profit of the village or municipality concerned. The sale value of wood material in the loess region indicates that a considerable revenue would accrue to the villages.

The reduction of erosion, or the prevention of excessive erosion in the loess uplands is an important part of the flood control measure for the plains. It must not be overlooked. Filling the erosion gullies with trees rather than covering the hills with trees is the solution, and likewise should become, when efficiently carried, out a self-supporting enterprise.

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Publications of  
THE UNIVERSITY OF NANKING  
COLLEGE OF AGRICULTURE AND FORESTRY  
NANKING, CHINA

September, 1926

Circular No. 11

**THE NEMATODE DISEASE OF WHEAT AND ITS CONTROL.**

By R. H. PORTER, *Department of Biology.*

**Prevalence and Importance of the Disease.**

The nematode disease of wheat is very common in wheat fields around Nanking and it has been observed in many places in North China, particularly around Kaifeng, Honan and Nanhsuchow, Anhwei. The percentage of loss varies from year to year depending on such factors as climatic conditions, cultural practices and crop rotation. In many fields the loss may run as high as 15 per cent but commonly the loss is much less. In some localities farmers consider this the most destructive disease of wheat they have. Apparently the nematode disease of wheat has been prevalent in China for many years and the total loss which it has caused can hardly be estimated.

**Signs of the Disease.**

The disease may manifest itself on any part of the wheat plant above ground.

1. *On Young Plants.* On young wheat plants the younger leaf blades become rolled, twisted and wrinkled. Sometimes small swellings resembling galls are produced on the infected leaves. In severe cases the young leaves are so badly infected that they become bent and break through the older, outer leaves carrying the young stem with them. This condition makes the stem grow out at right angles to the plant and later curve upward again. Many plants, if they become infected in the early stage of growth will die before a head is produced.

2. *On Older Plants.* It is common on older, infected plants for the stem to be bent at several places at the nodes. Commonly the first bending occurs near the surface of the ground. Other bendings may occur on one or several nodes above the ground. Very frequently the head itself may be bent and distorted so that it is almost at right angles to the stem. Infected nodes are usually somewhat enlarged.

3. *On the Heads.*—The surest signs of the disease occur on the heads of diseased plants. Such heads are usually shorter than healthy heads and the glumes open wider giving the head a thickened appearance. Diseased heads also remain green longer and therefore mature later than healthy ones. Inside the glumes are produced small, dark brown galls, resembling a normal wheat kernel somewhat, but without

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such a prominent groove. These galls are shorter than normal wheat kernels and may be thicker. Inside the galls there are produced large numbers of tiny, microscopic worms called eelworms or nematodes.

#### **How the Disease is Spread.**

The tiny worms which cause the disease live in the soil, in the old wheat straw and in the galls of the head as described above. These worms may be carried from place to place in wheat seed, wheat straw and by soil on the feet of man and animals and by farm implements. When wheat is planted the young worms if present are able to move about in the soil until they find a wheat kernel. They bore into the young seedlings and increase in number sufficiently to produce the symptoms described above.

#### **Host Plants.**

The wheat nematode is known to attack wheat, rye, oats, spelt and emmer. It has also been reported to occur on barley but the greatest injury occurs on wheat.

#### **How to Control the Disease.**

It is not difficult to check the nematode disease of wheat if the proper methods are used and if people in a community will cooperate. The following methods are quite successful.

1. *Use clean seed.* It is well-known that the most important agency in the spread of the disease is wheat seed. During threshing the nematode galls are scattered through the wheat and naturally go wherever the wheat goes. Whenever possible a farmer should endeavor to secure seed each year from a field that has no nematode in it. When this is impossible it is best to clean the seed with a salt solution as follows: dissolve 2 cabbies of salt in 10 cabbies of water and then pour the wheat into the solution slowly, stirring the seed constantly. During this operation all of the nematode galls and other kernels light in weight will rise to the top and the heavy, healthy kernels will sink to the bottom. The galls may then be skimmed off and thrown away and the good wheat after being removed from the solution should be washed in fresh water and spread out to dry. When dry it may be planted or stored in sacks for later use.

3. *Crop rotation.* This is very important because the wheat nematode does not thrive well in soil planted with such crops as beans, peas, corn or grass. It has been found that if wheat and other grains are kept off of land for one year the disease may be kept in check provided clean seed is used. It is best therefore to grow wheat on the same piece of land only every other year.

4. *Sanitation.* Great care should be exercised to prevent the spread of diseased wheat seed, straw, or roots on which the nematodes may be found. If a field is badly infected, the stubble should be plowed very deep as soon as the crop is removed in order to bury all of the stalks. The Chinese method of removing the roots soon after harvest has at least one advantage in that it destroys a source of infection.



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Publications of  
THE UNIVERSITY OF NANKING  
COLLEGE OF AGRICULTURE AND FORESTRY  
NANKING, CHINA



February, 1927.

Circular No. 14

**KERNEL SMUT OF MILLET AND ITS CONTROL.**

By R. H. PORTER, Department of Biology.

*Importance of the Disease.* Millet is one of the most widely cultivated summer crops in North China. One of the commonest diseases of millet is kernel smut which, as the name indicates, destroys the grain in the head. This disease has been found in the provinces of Shantung and Honan and specimens have been received from Chihli and Shansi. There is every indication that smut is coextensive with the cultivation of millet in China. The loss caused by the disease can not be accurately stated, but, in many cases, it runs quite high. In individual fields in Shantung it is not uncommon to find 50 per cent of the heads partially or entirely destroyed. The loss in the average field is much less. Field tests at the agricultural experiment station of the University of Nanking show that badly infected seed produced a crop in which 20 to 30 per cent of the heads were smutted. This resulted in a decrease in yield of 25 per cent, which is a heavy reduction. Because of these large losses incurred by Chinese farmers, control measures for this smut disease are important.

*Signs of the Disease.* Diseased plants are not readily found in the field until some time after the heads appear, although by careful inspection they may be found before the heads emerge from the sheath, in which case the glumes enclosing the smut masses appear whitish and translucent. After the heads come out the diseased ones usually have a peculiar dull yellow, unhealthy color. The grains or kernels of the head are destroyed by the smut fungus which at first consists of a slightly enlarged smut ball surrounded by a thin, yellowish white membrane. Later this membrane breaks open exposing a black mass of smut spores. The heads of foxtail millets are so compact that often one side of the head may be a mass of smut due to the bursting of all of the membranes surrounding the individual smut balls. Smutted heads are light in weight and produce little or no grain. At threshing time the spores are scattered to the sound kernels where they remain until

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the seed is planted. As the young seedling develops, the smut spores germinate, penetrate into the young plant, grow up through the stalk and finally destroy the grain as described above. So far as known, the smut spores are carried and remain alive only on the seed, not in the soil.

*Control Measures for Smut.* In order to control the kernel smut of millet there are two things to remember; viz., (1) the spores are scattered to sound kernels mostly at threshing time and (2) the disease is seed borne. Control therefore consists of two methods as follows:

1.—*Careful selection of seed.* Every farmer should select sound heads free from smut before the crop is harvested. It is best to begin the selection work just as soon as some of the heads are nearly ripe. Early maturing heads, if large and well developed, are of value. Enough heads should be selected to provide seed for the following year, but they need not all be secured at the same time. These smut-free heads must be threshed and stored separately away from common seed in order to prevent contamination. This method of seed selection will greatly reduce the amount of smut and also produce a higher yield than can be expected from badly infected seed.

2.—*Seed Treatment.* Since the spores of this smut are carried only on the surface of the seed it is possible to treat the seed with certain substances which will kill the smut spores without injuring the viability of the seed. There are several chemicals, both liquid and dust, which are efficient disinfectants and may be used with good results, but since the dusts are more readily applied, two of these will be mentioned.

(a) *Copper Carbonate.* This is a finely pulverized blue green powder which may be used to treat millet seed before it is planted. It is the same substance recommended for the control of Kaoliang Kernel Smut in Circular No. 8. One-half Chinese ounce of the powder is sufficient to treat 15 catties of seed by the following method:

1. Clean the seed thoroughly by removing all dirt and chaff before treatment. Pebbles or small pieces of dirt are not so objectionable as very fine soil because the latter mixes with the copper carbonate dust and interferes with its fungicidal action.

2. Place the seed in a machine such as is illustrated in Plate I, or in any other container which is supplied with a tight cover.

3. Add the required amount of copper carbonate and shake the mixture until all of the seeds are covered with a bluish green powder. This may require about 10 minutes. After treatment, the seed may be planted at once at the regular rate of seeding or stored until later, if desired. Too much of

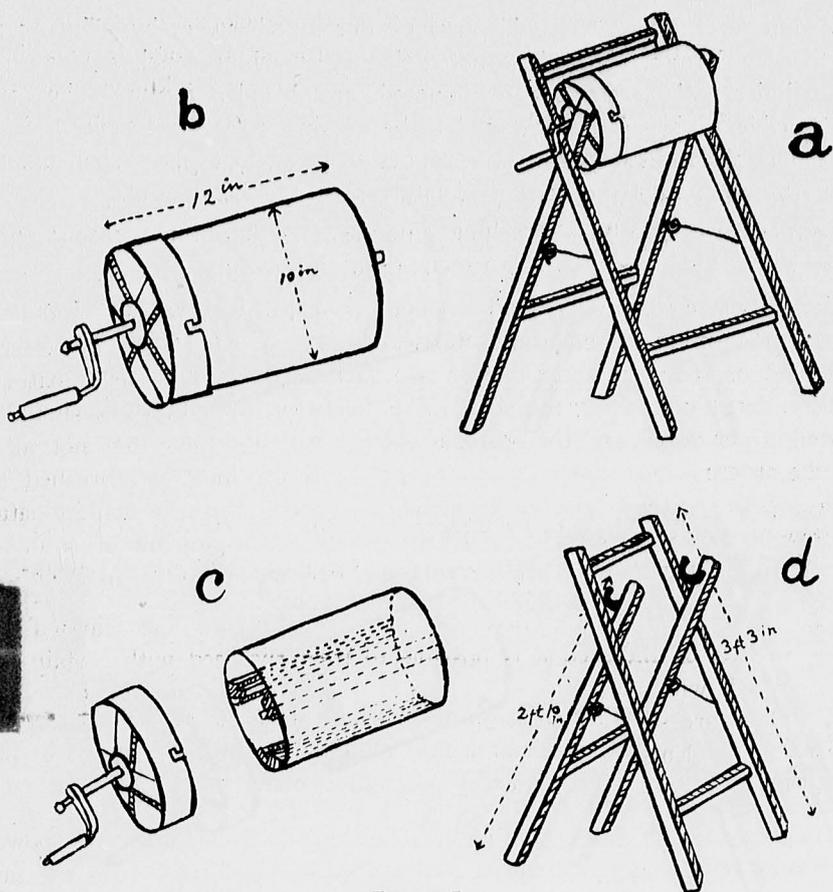


PLATE I.

- a. Seed treatment machine ready for use.
- b. Galvanized iron drum with detachable top.
- c. Interior construction of drum showing wooden cleats to aid in mixing of grain.
- d. Wooden stand which can be folded when it is desirable to transport the machine.

the powder will not injure the seed; in fact, it is better to use too much than not enough.

(b) *Tillantin "B."* This powder is darker in color than copper carbonate but similar in that it will control smut and will give a substantial increase in yield over untreated seed. It may be used at the same rate and applied in the same way as described for copper carbonate. It may be purchased of the China-Export-Import and Bank Company, Ltd., of Shanghai.

A small home-made machine (pictured in Plate I) is very valuable to treat not only millet seed but also kaoliang and wheat. It can be made for

\$2.50, and several farmers could purchase one together thereby reducing the cost to each farmer. It will be noted that the machine consists of a sheet iron cylinder with a central core mounted on a wooden frame. The cover is detachable, which allows the seed to be put in or removed easily. After the seed is placed in the drum, the copper carbonate may be added and the drum revolved until the dust is thoroughly mixed with the seed.

*Supply of Copper Carbonate Dust Available.* The College of Agriculture and Forestry of the University of Nanking will furnish, on request, small envelopes each containing enough copper carbonate dust to treat 10 cattles of seed. The minimum charge, exclusive of postage, is four cents per packet. Since the postage is high for one or two packets, it is advisable to order in quantity, thereby reducing the cost. The following table gives the net cost, the weight per parcel and the postage together with the total amount to send with the order:

<i>Number of packets</i>	<i>Gross Weight</i>	<i>Cost</i>	<i>Postage</i>	<i>Total</i>
1	20 grams	\$ .04	\$ .04	\$ .08
10	250 "	.40	.20	.60
20	450 "	.80	.20	1.00
50	1,000 "	2.00	.20	2.20

If ordered in bulk the material can be furnished at \$.70 per pound or \$1.55 per kilogram, plus 20 cents addition for postage in each case. Money may be sent in stamps or by post office money order.

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Circular No. 8

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**KERNEL SMUT OF KAOLIANG AND ITS CONTROL.**

By R. H. PORTER, *Department of Biology.*

*Importance of the Disease.*—This disease occurs in east and north China wherever kaoliang is grown. The amount of loss caused by it is not definitely known because extensive surveys have not been carried out. Observations in the provinces of Kiangsu, Anhwei, Honan and Shantung, show that in individual fields the number of infected plants ranges from 2 to 6 per cent. A diseased plant is a complete loss so far as grain is concerned. Reports and specimens from Chihli and Shansi Provinces indicate that the disease is common and causes considerable loss. The amount of loss varies in different seasons and in different regions but in any case it is important enough to deserve some attention for its control.

*Signs of the Disease.*—Infected plants are not readily detected in the field until the head begins to emerge from the sheath. At that time careful examination will reveal a pale colored panicle in which the individual florets are covered with a thin, whitish membrane. This membrane encloses a dark mass of smut spores which does not become exposed until the head is well out of the sheath, at which time the head appears dark in color but normal in shape and outline. The kernels are simply replaced by the mass of smut which soon bursts open and is scattered to adjoining healthy heads by the movement of the wind. At threshing time the smut spores are further scattered on the surface of the seed where they remain, until the seed is planted the following year. In the spring when the seed germinates, the smut spores also put out small germ tubes which penetrate through the seed coat, grow up through the stem as it grows and finally prevents the formation of grain. It is not uncommon to find the stalks, bearing smutted heads, somewhat stunted, but this is by no means a characteristic of diseased plants.

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*How to Control the Disease.*—Since the spores of the fungus live on the surface of the seed and infect the seedling the following year, it is necessary to treat the seed with some substance which will kill these spores without injuring the seed. Copper carbonate, a bluish green powder is such a substance. One half of a Chinese ounce of the powder is sufficient to treat 15 catties of seed. The method is as follows:

1. Thoroughly clean the seed so as to remove dirt and chaff. Seed without hulls is more effectively treated than that which has hulls on it.

2. Place the seed in a container which is supplied with a tight cover. A small wine keg with a tight fitting cork is satisfactory. It might be desirable for several farmers to have an iron can made with a tight cover which could be used by all of them for the purpose of seed treatment.

3. Add the copper carbonate dust and shake the seed thoroughly for ten minutes or until all of the seeds are covered with the bluish green powder.

4. After treatment the seed may be planted at the regular rate of planting.

This method of treatment causes no injury to the seed, in fact it often stimulates it by killing spores of other fungi which cause seedling injury.

Small packages containing enough powder to treat 15 catties of seed may be secured from the University of Nanking, College of Agriculture and Forestry, at six cents per packet, including postage. If purchased in quantity they can be secured at a cost of about four cents per packet.

*Note.*—This method does not control the head smut which often stunts the plants and prevents the emergence of the panicle, producing in its place a smut ball. This ball may be 2 or 3 inches in diameter and is at first covered with a thin membrane which later breaks open, exposing a black powdery mass of spores. In some cases only the lower part of the head may be affected, but the upper part seldom produces much grain. This smut also attacks corn.

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Circular No. 9

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PLANT LICE AND METHODS OF CONTROL.

By R. H. PORTER, *Department of Biology.*

*Economic Importance.*—Plant lice or “aphids” are widely distributed in all parts of the world and China is by no means free from these pests. They attack such crops as kaoliang, corn, beans of all kinds, wheat, cabbage, tobacco, all kinds of squash and melons, as well as many kinds of fruits, flowers and shrubs. It is impossible to estimate the loss from these insects because it varies in different seasons. In the spring of 1924 hundreds of acres of wheat in North China were destroyed and during the summer of 1925, kaoliang in Anhwei, Honan, Shantung and even up into Manchuria was badly damaged by lice. It is safe to say that plant lice are among the most destructive insects in China.

*Description of Plant Lice.*—Aphids are very small, soft-bodied insects, the largest being less than one-fourth of a Chinese inch in length. They usually have long, slender legs and are of various colors such as green, black, red, brown, white and gray. In some cases their bodies may be partially or completely concealed by soft, white or gray waxy threads, giving them a “woolly” appearance. Most forms have no covering. While lice are feeding on plants they give off a clear, sweet fluid known as honey-dew. Ants are very fond of this honeydew and for that reason often care for the lice by putting them in their nests at night and in the morning bring them out and put them on plants to feed. It is also common to find a black fungus growth on plants where lice are feeding. This fungus grows on the honeydew and gives the plant a dark, dirty appearance. The injury caused by plant lice is due to their sucking habits. They suck the moisture and plant juice from inside the stems and leaves so that the plant ultimately dies from loss of food and water. It is also common for the leaves to roll up with the lice inside where they are protected from injury.

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*Life History of Lice.*—In most cases the eggs are laid in the fall on some part of the host plant. The following spring these eggs hatch into young "nymphs" which are able to give birth to living young, each female producing from 10 to 100 offspring. These offspring begin to feed at once and soon are large enough to produce more young lice. The number of generations per year ranges from 8 to 21 which explains why lice become so numerous in a short time. During the growing season if the food plants are insufficient for the needs of the lice, they are able to produce "winged" forms which can migrate for some distance to a more favorable feeding place. Certain species of lice have two or more host plants on which they feed. For example, one species feeds on apples late in the summer and remains there until spring at which time it migrates to crops like barley and wheat.

*Measures for the Control of Plant Lice.*—Control measures may be divided into two classes, namely, natural and artificial. In most cases man has little control over the natural methods but he should know something about them. Natural methods are (1) climatic conditions and (2) parasites. Cloudy, wet periods of weather are favorable for lice although heavy, beating rains destroy large numbers. Sudden cold periods in the spring, following warm, sunshiny days cause death of many of the early species. If it were not for the natural parasites, lice would be even more destructive than they are. Numerous small flies kill lice by depositing eggs on their bodies which hatch into small maggots that feed on the interior of the bodies of the lice. The most important parasite of lice is the lady bird beetle family. This family contains many different species, varying in shape and color. In general they are shaped like one half of a pea seed, being oval on top with two wing covers which are usually marked with one or more dots of different color than the wing cover itself. For this reason, they are often classified as two-spotted, nine-spotted and twelve-spotted lady beetles. Their wing covers may be red with black spots or black with red or yellow spots. These beetles as well as their larvae are nearly always found wherever there are plant lice. They eat the lice and in this way destroy large numbers of them. Lady bird beetles should not be destroyed because they are the farmers' friends.

When, as is often the case, natural enemies fail to keep lice under control it is necessary to use some material which will kill them. In order to do this, a substance must be used which will completely cover their bodies and prevent breathing through their small body open-

ings. For this purpose, there are three solutions which rank in effectiveness in the following order:

1. Nicotine Sulfate. This substance is a very concentrated tobacco solution which, when diluted at the rate of one teaspoonful to six catties of water, may be sprayed on any plant infested with lice. For this purpose it is best to use a spray machine. The University of Nanking can supply a small hand sprayer at a cost of \$1.45, plus the postage. It is satisfactory for vegetable crops and for small fruit trees and flowers. The solution must be sprayed directly on the lice, otherwise they will not be killed. Furthermore, the spraying should be repeated at least once within one or two days. In any case it should be applied until the lice are all dead. The solution is the best known remedy for plant lice but it is quite expensive. It may be purchased from the College of Agriculture and Forestry, University of Nanking, at 50 cts. per ounce. This amount is sufficient to make up fifty catties of solution.

2. Tobacco tea. This is a home-made remedy prepared as follows: Soak 1 catty of dried tobacco stems or leaves in 8 catties of water during one night. It will help some if the solution is heated over a fire after the evening meal. The resultant solution may be used without dilution and sprayed in the same way as described above.

3. Kerosene emulsion. Prepare this solution as follows: Shave one Chinese ounce of fishoil soap into one catty of boiling water. As soon as the soap is dissolved remove from the fire and add 2 catties of kerosene oil. Stir this solution constantly for at least ten minutes until an emulsion is formed. Before using, dilute this solution at the rate of one catty to 15 catties of water and apply only on bright sunny days. Kerosene emulsion will kill lice, but it is more liable to injure the leaves of plants than are the tobacco solutions. With any solution it is necessary to be thorough and persistent in order to kill the lice. Furthermore, spraying should begin before the leaves commence to roll.

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Bulletin No. 15

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A GLIMPSE AT  
RURAL NEEDS AND THE RURAL CHURCH  
IN CHINA

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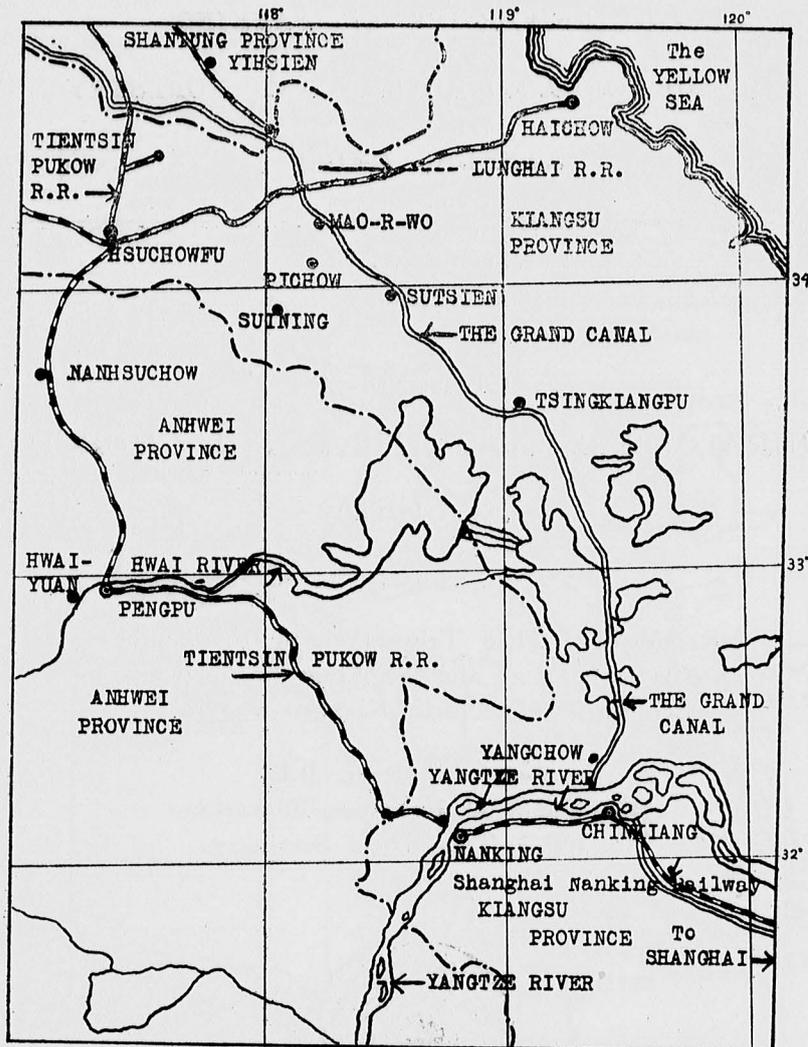
Report of a Field Trip taken by the Senior  
Class, 1926, of the Nanking Theological  
Seminary into North Kiangsu Province.

Frank W. Price, B.D.  
Department of Religious Education,  
Nanking Theological Seminary.



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November, 1926.

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This map shows the route taken and the territory covered as set forth in the following report. Beginning at Nanking the group traveled North to Suchowfu on the Tientsin-Pukow Railway; thence East on the Lunghai Railway to the Grand Canal. The trip South was made via the Grand Canal to Chinkiang and thence to Nanking by the Shanghai-Nanking Railway. Ten modes of travel were used.

## PREFACE.

Thoughtful students of the Chinese Christian Church are day by day more clearly recognizing the fact that the rural church is the weakest link in its chain of Christian organization, activities and expression. Baffling are the problems of adaptation, involving as they do restricted standards of living, low economic efficiency, illiteracy and superstition, age-old social customs and religious beliefs and practices. Great are the discrepancies between the training now being provided for rural Christian leadership, the ability of the local Christian groups to support it, and its application and adaptation to the needs of rural communities.

Two questions emerge which those responsible for the direction of the rural church should be able to answer comprehensively and convincingly. First, shall the rural church be a serving church at the same time as it is a worshipping church or shall it only be the latter, as is the predominant emphasis at the present time? Second, how can the rural church be a serving church without taking into active consideration the improvement of agriculture and the enrichment of rural life? The time has come when services to the economic and social needs of the rural community must be given equal recognition with all other forms of Christian service for which the Christian church is making large investments in personnel and funds. We need the community church idea in the country as well as in the city—only more so.

To some, the following account of the field trip taken by the senior class students of the Nanking Theological Seminary with their teacher Rev. Frank W. Price will carry them back over personal experiences—old stuff perhaps, but no one, I believe, can read the report without feeling anew the need and challenge of the rural peoples to the Christian rural church and the necessity for a change in approach that will more adequately than in the past, take into consideration the good tidings of Jesus to the poor—that they need not be poor any more and that Jesus meant exactly what he said that he came that men might have more abundant life—in every form. The redemption of man will never be assured until his environment and the earth have also been redeemed. Does the Christian Church in China have the courage to meet the challenge of this report?

The College of Agriculture and Forestry appreciates the privilege of being able to publish the report as an evidence of its interest in the rural church and in the country people whom it earnestly desires to see the church serve more widely.

JOHN H. REISNER.

**A GLIMPSE AT  
RURAL NEEDS AND THE RURAL CHURCH  
IN CHINA**

By FRANK W. PRICE.

**Adventure Brings A Revelation.**

"It is like coming from another country," said one of the group on his return to Nanking. Three hundred miles from the high-walled old capital, Nanking, from universities and modern streets, from comparative security and comfort, from a sequestered Seminary campus, from academic discussions of the rural church! Three hundred miles to Northern Kiangsu; to mud-walled villages on dusty plains, to one-room schools in every tenth hamlet, to ways of living centuries old, to a land of poverty and fear, to where rural China lives, to walk among the toilers of the soil, to observe and to serve the struggling rural church! And yet three hundred miles does not begin to measure the difference between urban and rural ways of thinking and living, between the needs of city people and of the rural masses, between the problems of the city church and of the rural church.

Early in March, 1926, eight students about to graduate from Nanking Theological Seminary and the writer started on a three weeks' field trip through part of Northern Kiangsu. The trip was planned in response to an invitation; it was undertaken as a project of study and service, as an adventure in rural evangelism. It ended in a revelation—a revelation of rural needs and of the opportunity of the rural church. This report is an effort to record some of the adventures and impressions of this revealing experience.

In the loop which we followed (see map, page 2)—up the Tientsin-Pukow and over the Lunghai railways, across country and down the Grand Canal, ten modes of travel were used; horse carriage, river ferry, train, rickshaw, canalboat, ox-cart, wheelbarrow, motor-cycle, steam launch and "by foot."

**Bandits and Poverty.**

The original plan had been for us to spend a week each east and west of the Grand Canal, but it was decided at the last minute to concentrate on the west side. With the coming in of Kiangsi soldiers, bandits were much fewer and the countryside more quiet than for years.

[ 5 ]

We had nerved ourselves for any kind of experience but little excitement beyond occasional reports of holdups and sounds of shooting some nights in distant villages. Every moment, however, we were in an atmosphere of dread memories and dread fears. Years of wars, looting, banditry and famine have left a dark shadow over the land and our first and last impression was POVERTY—poverty of body, mind and spirit.

Our work was in towns and villages of three counties, Pichow, Suining and Sutsien. The country here is quite flat and much flooded in the summer time. The market town is the center of rural trade and life and the market days, which come four times in ten days, draw in crowds from the outlying hamlets. All market towns and the "wei-tz" villages are surrounded by mud walls and have one or more gun-towers (p'ao-lou) for protection against bandits. These towers, costing from forty to one hundred dollars, have been built by the people themselves during the recent troublous years. Village houses are built of mud and are heavily thatched, making the villages in winter almost the color of the countryside. A few brick houses are found in market towns and a larger number in the hsien (county) cities.

**Surveys Reveal Needy Conditions of Countryside.**

Each member of the group conducted surveys in some phase of rural life and rural church work. It is possible here to give only some outstanding facts which bear upon the problems of rural evangelization. The land in this section is still largely in the hands of farmers, between 15 and 20 per cent of the land being tenanted. Landlordism does not seem to be increasing; the break-up of families is increasing individual holdings. It was not uncommon to find a family of five trying to eke out an existence on 6 mow (one acre) of land. Agricultural products have risen in price more rapidly than labor. This should favor the farmer but for the depreciation of land values where banditry has been worse, and for famines, plant diseases, and the rising cost of living. We found living costs 50 per cent higher than in Nanking, but the average income much less.

Here, as in most rural districts, credit can only be obtained at exorbitant rates, 3 to 4 per cent a month. In Suining a careful observer estimated that 30 per cent of the borrowing was for economic, and 70 per cent for social (gambling, weddings, funerals, etc.,) purposes, showing that poverty has roots not only in poor agricultural conditions and credit facilities but also in pauperizing social customs and unwholesome pleasures. Borrowing is on the increase. The largest pawnhouse in Suining does a business of

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\$200,000 to \$300,000 a year, the articles pawned being mostly farming implements and winter clothes. Not much land is mortgaged. Although there is some weaving, iron work, carpentry and poultry-raising, etc., to supplement the farming income, the winter months are largely idle and wasted. Among the younger farmers there is considerable restlessness. I talked with one eighteen year old lad on the Lung-Hai train who was leaving home to look for a job in Suchowfu. "I am one of a family of eight," he said in explanation, "Our annual income at best is ninety dollars. What else can I do?"

#### 25 per cent of the People Live on Starvation Line.

At least 25 per cent of the people live on the starvation line, eating little more than bean cake soup, sweet potato leaves, or dry steamed bread. One student reported that in Lu-chen 15 out of 50 families were living on bean-cakes. This condition shows ignorance and poor management as well as poverty. Farmers sell their beans to the bean-cake factories, and buy back the cakes for fertilizer and for their own food at a higher price per pound than the chickens which they raise can bring! At the other end of the scale are a few rich land-owners. In Suining there are four wealthy families each owning over 4,000 mou of land. One student reported a man in Taishan owning 12,000 mou; another, a family having 30,000 and one 20,000 mou. Between these extremes is the average farmer, struggling for his living against heavy odds, heavily in debt, tempted to banditry, living much as his forefathers did, yet withal remarkably cheerful and patient. The cleverer and more adventurous move toward the towns and cities. The 10 per cent merchant class in market towns and cities maintains fair standards of living.

#### The Old Gives Way to New.

New habits and ideas are penetrating slowly but surely into the rural communities. The cigarette is everywhere. In the walled villages are always some men of education who subscribe to a newspaper. The gentry and business men of Suining I found divided into two parties, the Kung-ho fighting for vested rights, and the Kuo-min for more democracy. One student asked his wheelbarrow man when travelling through the country about the conditions at his home. "Oh, it's bad now, but it will be better soon, for China is going to be like the foreign country." "What foreign country?" "Russia!"

#### Schools Gradually Increasing, Teachers Averaging \$5 per month.

Schools are increasing, modern text books are being introduced and the old private schools are evolving into reformed private schools, "Kai-liang a shuh," but the educational need is not beginning to be met. At least half of the larger villages are without any kind of school and the existing schools are not rural schools in any sense. Some villages and hsiens have land upon which to depend for educational funds, but these cannot go far. Suining county spends \$17,000 a year on 150 schools in the prefecture, and the average salary for a teacher is \$5 per month! The Christian Church has established over forty schools in the three counties which we visited; these are receiving in most places the interested support of local citizens and are making a genuine contribution to the community as well as to the church. But they lack equipment, trained teachers and a rural program. The crying need for elementary education throughout the country was brought home to us again and again as we visited villages without schools and held up the Chinese flag. Often not a child out of forty or fifty would recognize it. In the villages to which members of the group went, estimates of the percentage of children in school varied from 10 to 25 per cent. Very little popular education among illiterates is being carried on.

#### Crowds of Friendly Children.

It was always easy to draw a crowd of children, and they appealed to us as the great, hardly touched field of the church. One of the group described them as "having little general knowledge, dirty, curious, active, addicted to gambling, friendly, lovable." They are full of spirit but easily controlled by friendship. Most schools tend to repress their energy and crush their spirits. One member of the group made a comparative study of boys attending a Christian school and a public school in the same village and graded the Christian school boys as better in obedience to parents, in physical development and in willingness to work, while the public school boys excelled in general habits, in polite manners and conversational ability (due perhaps to the higher class of homes from which they came) and in general knowledge and citizenship training.

The children have their games, simple toys and holiday amusements, but the most prevalent diversion among them as among adults is gambling. Next to gambling most money is spent on drinking and smoking. A village elder in a village of 200 families near Maorwo estimated that \$1,500 a year was wasted on cigarettes and wine. Children were often seen smoking.

**"They That Are Sick."**

Modern hygiene and health education are practically unknown. There is one mission hospital at Sutsien for this whole field and through the field several men who have had two or three years of nurses' training or as hospital assistants are now hanging up their shingles as doctors! We could get no reliable information anywhere on infant mortality, but it must be very high. The average family has only three or four living children.

**Rural Religious Life—Secret Religious Societies Flourish.**

Every little village has its "Tu Di Miao (shrine of the local god and goddess of the land) in or near it. The larger villages and towns have temples supported by local funds. The most common temples being the Kwan-ti-miao. Taoist temples are also common. In the town of Tsaoho were found 8 temples and 7 "Tao-teh hwei she" or Philanthropic organizations. There are very few priests, yet a large amount of money is spent on idolatrous worship, superstitious practices and in the idolatrous festivals which combine worship and amusement. Even the small child knows the names of the familiar paper gods and joins in ancestor worship. We found many evidences of secret religious societies. The "San-yuan-hwei" is very widespread. At a large country fair I saw two members of a secret society giving proof(?) that they were immune from bullets by shooting blank cartridges at each other!

**Christian Churches Center their Activities in Preaching and Worship.**

The church has been established for thirty years in this area. From the beginning, the mission's policy has been to found chapels and schools in strategic centers, and every one of us felt the deepest respect and admiration for the pioneers who worked against almost insuperable difficulties and with great sacrifice to introduce the Gospel here. There are at present 33 chapels in the three hsien and 14 Chinese workers, each in charge of from one to four points. The churches are 25 per cent self-supporting as far as running expenses are concerned. Land and buildings have been contributed partly locally, partly by the mission. Schools in all cases are partly subsidized. The workers' salaries run from \$9 per month to \$15 with allowances for children. Most are graduates of Bible schools or of Tunghsien Seminary, two are graduates of Nanking Seminary. The membership of the churches runs from 3 to 60 and averages about 30. Members are largely farmers and adults, with comparatively few women

and few of the gentry and business class. The program of the churches is largely centered about preaching and worship. Religious education, community service and the training of Christians have not been stressed. Other points in connection with the churches of this area will be found in connection with the report of our two weeks' program.

**The First Week's Program.**

Houston Patterson met us at Yuinho station on the Lunghai Railway and took us, after we had eaten a dinner of sweet potatoes, to our first point, Mao-r-wo (Cat's Nest) on the Grand Canal. Patterson described this as one of the most difficult places in the field and wanted us to begin with a hard proposition! The first test was sleeping on straw on a mud floor, eating two meals a day and washing out of one basin! But the group took it as fun. Immediately after arrival, we divided into small groups to sing and speak on the streets of the small town and to advertise our evening meeting. A crowd jammed the courtyard of the little chapel for the evening stereopticon lecture on citizenship and the Life of Christ. Before it became dark, we distributed song-sheets and got the people, especially the children, to singing the hymns with Chinese tunes.

**The Youthful Village Elder Cooperates.**

Mao-r-wo is a typical village with its mud wall, long market street, and a population of about 1,000. We tried to cover the village by street preaching or by visitation. We were given opportunity to speak in the Public Primary School, and called on the young village **tong-s** (elder) a lad of twenty-one. He is the only middle school graduate in the village, having studied at Chinkiang 6th Middle School and hence is looked up to with much respect. The mantle of several generations of elders in his family has fallen on him. He was much interested in the work of our group and invited a group of ten leading men of the town to meet some of our students in his home. One of our group spoke on "Needed Reforms in Rural Communities" another on "What is Christianity?" another on "What can the Church do for this Community?" and our leader appealed to them to study Christianity and to help the Church in its work. The men of the village listened with great interest and several came to the chapel later.

**The Children Have Their Day.**

One afternoon was given entirely to children, with two hours of group games on a large open ground, followed by songs and stories. The

audience of adults was larger even than the number of children who participated. In leading these games, the students were able to put to fine use some special training in boys' work and game leadership which they had had in connection with their Religious Education courses at the Seminary.

#### **The Prodigal Son is Dramatized.**

We covered the walls of the chapel and of the courtyard with the pictures and charts which we brought, and hours were spent each day explaining these to visitors. The second evening we gave special music and gramophone records, followed by preaching. The final evening we gave a dramatization of the Prodigal Son in six acts, followed by a powerful sermon by one student. The dramatized parable with the effective acting made a deep impression on the crowd of four hundred people which stood for an hour and a half. During the scenes when the prodigal was singing his song of woe and when he returned to his father's arms, many were weeping. An added touch to the story was the conversation of a preacher with the prodigal when he was in misery.

#### **A Fine School without a Rural Program.**

In addition to work in the town our men visited several neighboring hamlets. One Christian school three miles away came in a body two days to the chapel. The children received pictures and were especially delighted with the health tracts. I visited this school one morning and found a fine brick building built by local people. The interior wall was decorated with the English and phonetic alphabets, but the school had no rural program of any kind.

#### **From Village to City.**

After three days at Mao-r-wo we walked 20 miles across country to Pichow, a hsien city. The work here is of a somewhat different type, as Pichow has a population of 10,000 and there are many kinds of business in the city. Our audiences here were city people with some farmers. Pichow was a large and important city until the 5th year of Kanghsi (1667) when the Yellow River suddenly changed its course and inundated most of the city. But it still retains an atmosphere of ancient civilization and culture, and we found a comparatively large number of well-informed, wide-awake gentry, business men and educators.

#### **Church Leadership the Difficult Problem.**

The preacher at Mao-r-wo had been uncouth but tremendously in earnest. The preacher at Pichow was old and gentlemanly but asleep in the face of great opportunities. We heard soon after arrival that the relations were not cordial between the church and local people. However, in all our approaches to the local leaders, we were met with great interest and friendliness. The church here has two chapels, the larger on a rise of ground just out of the city and the other a street-chapel, also one school for boys and one for girls. All the chapels are known as Fuh-in-t'ang (福音堂) or Ye-su-t'ang, (耶穌堂) not by any denominational name.

#### **The Program at the County Seat.**

Our program at Pichow followed the same lines as that at Mao-r-wo. We first endeavored to meet with and arouse the Christians, held special meetings in both chapels, gave the stereopticon lecture in the street chapel to a crowd that almost swamped us, conducted a children's afternoon, in which both boys' and girls' schools from the city took part to the interest and amazement of onlookers, spoke to a meeting of forty literati and business men in the large public boys' school, preached at points over the city, and repeated the dramatization of the Prodigal Son. At least six hundred people saw this dramatization given from the natural balcony in front of the church, and listened to the sermon at the close. After this, the children would call members of our group by their parts in the play. "Here comes the Prodigal, the Older Son, the gambling companions, etc."

#### **Group Work gives way to Individual Projects.**

A large number of Christians and enquirers turned out to the Sunday morning service, which starts in the country when the sun gets "so high" in the sky. Special emphasis was placed on the worship and music, for country services tend to become stereotyped and dry from Sunday to Sunday. A sermon to Christians was preached from concrete object-lessons. Then one student conducted a model Sunday School, with five classes—Christian men, Christian women, enquirers, boys, girls, taught by members of our group. The great difficulty in any program of Christian training in rural churches is lack of leaders and one of chief emphases in the work of the church should be on the training of such leadership among its own members.

At our last group meeting, on Sunday evening, each one outlined his own plan for his second week of intensive work, and we prayed earnestly

that the Spirit of God which had guided us as a group would guide us individually. Early Monday morning, we scattered to seven different points, some more than a day's journey away.

#### **The Second Week Young Theologs Preach to Rural Audiences.**

Each member of the class has written a detailed report of his intensive week. I can only give a brief summary of the most interesting and valuable points in these reports. The second week's program varied in the different places according to conditions in the communities, the cooperation of preacher and church-members and the special interests of the different members of our group. Each student preached a series of sermons to church-members and preached in the evening to non-Christians. Some of the sermon series were: Mr. Wang, Improving society, Sin and Repentance, Who is Jesus? What is the Gospel? How to become a Christian. Mr. Fan: God, Man, Jesus, Sin, Faith, The Cross. Mr. Chen: Jesus, the Great Physician, The Great Friend, the Great Teacher, the Son of God, the Saviour of the World. Mr. Shao: The Christian's Responsibility, Learning Jesus, "Looking to heaven . . . and giving," Jesus' three Parables of the lost, Jesus' three "I's" and three "you's". All the men agreed that although they found rural preaching had to be simple, practical and concrete, yet the themes of God, Christ and individual and social redemption should be at the heart of it.

#### **Daily Conferences bring Inspiration and Experience.**

All of us had daily prayer services with a small group of leaders and church members. One prayer group met at 5.30 each morning. The rest of the day was given to visitation of Christians, visits to schools, special meetings for children, special lectures on citizenship and health, and personal work. Each of us conducted a training class for some of the most hopeful Christians and through this tried to stimulate interest in a religious education program and more voluntary service by church members. Much of the material which we took was introduced and explained to this group, and problems which they raised were discussed. We must pay a tribute here to the fine spirit in which the local preachers welcomed our young Seminary students with their many new ideas but less experience.

#### **The Fields White unto Harvest—It Costs to be a Christian.**

Unlimited opportunities opened up in schools of the community as well as of the church. One member of our group visited six schools

and was asked to speak in five. Patterson and I at Suining were invited to speak to the Lower Middle School there and all the other schools of the city attended the meeting. One student organized a week-day religious school to continue his contacts with public school students. All of us had special children's game hours and meetings. One man reported nine game hours and another told of a speech which he made to bystanding parents after one game hour, urging on them the necessity of physical and health education for children. Four had opportunity to speak to a meeting of gentry and business men, and others visited the "tong-s" and leading men of the village. One student tells us of several frank personal talks with the leading man of his village who owns practically the whole village.

We found that the church in many places had had little contact with this influential group, and we were surprised at their cordiality and their interest in the message and purpose of the church. Even among them there is very little effect of the anti-Christian movement so strong in the cities. Another student reported that several of the local gentry decided to help the church in starting a People's School, and offered to usher at one of the meetings. One man arranged a social for Christians and friends of the church.

The stereopticon was used in three places. At Suining the large court of the Taoist temple was secured for a children's afternoon and a stereopticon lecture in the evening. At least a thousand people attended this meeting; several primary schools coming in a body. One of our group directed the Christians in presenting both the Parable of the Prodigal Son and of the Good Samaritan. The pupils of the church primary school sang and helped in the program. Interspersed with these activities was a great deal of personal work, interviews with Christians, visits to homes and personal conferences. One student reports visits to 43 homes. Perhaps the most effective work of the whole trip was done in some of these personal talks. I know that nothing inspired me more than some visits to Christian homes in the country.

One old farmer I remember particularly well, who had a crippled future daughter-in-law, eleven years old, in his home, and although food was not enough for the members of his immediate family, refused to send her back or turn her out because "I am a Christian and they all know I am a Christian." And how our hearts ached as the farmers told us of their problems, their poverty, their temptations, their empty lives, and we wished that we might stay and try to bring to them more abundant life—economic, physical, intellectual, spiritual.

### The People Respond to the Enthusiasm of Youth.

As a result of the week's program and this personal work, together with the fine cooperation of the local preachers and workers, the Sunday congregations in each center filled the chapels. In many places there was the largest Sunday congregation in years. One of our number reporting this, added whimsically, "And the Sunday offering was also the largest they had ever had, 1,200 cash."

### Statistical Summary of Work Attempted.

According to our records the total number of sermons and talks given during the whole trip was as follows:

To Christian audiences .. .. .	77
To non-Christian audiences .. .. .	94
To gentry and business men .. .. .	16
To students in schools .. .. .	31
To women audiences .. .. .	2
To other groups, soldiers, children, etc. .. .. .	28
Total .. .. .	248

New work was started as follows: (Number of places)

Family worship .. .. .	2
Prayer groups.. .. .	5
Reorganized Sunday Schools .. .. .	6
Special Boys' Work .. .. .	6
Christian Endeavor .. .. .	1
Reorganization of R.E. in Church's School .. .. .	3
New Bible Classes .. .. .	3
People's Schools .. .. .	4
Daily Vacation Bible Schools (summer) .. .. .	8
Reading Rooms .. .. .	3
Personal Work Bands .. .. .	4
School Garden.. .. .	1

### Good Equipment is Essential.

On the material which we took, interesting reports were made. The Stewart Bible picture tracts were very popular. The Health tracts delighted the school children. The tract which we ourselves prepared was useful while some of the Christian Literature Society sheet tracts

which we had selected were best for general distribution. The two printed hymns to Chinese tunes were used everywhere and we gave copies to all who sang or attempted to sing. One student used his Chinese flute very effectively in accompanying our group singing. Of the large pictures which we took, the Daily Vacation Bible Schools and Citizenship pictures were voted the best by our group, and next to them the Health pictures. Altogether, the Daily Vacation Bible Schools material was the best which we took, for any kind of work with children. The Sunday School Union and Phonetic Script charts and pictures are poorly suited for use in the country.

Perhaps more pleasure was given by the Citizenship pamphlets than by anything we gave or sold. These are written in verse form to Chinese popular tunes and were very popular. As to the books which we took to the preachers, members of the group made such comments: "They were very grateful for this material, but they cannot afford to buy it," "The books were greatly welcomed," "He liked the books very much," "He liked the books on boys' work, organization of the Sunday School and on preaching best," "Every book was welcome," "The preacher had a very poor library and was delighted to get some new material to help him in his preaching and work," "The books were much welcomed and the preacher put them in the reading room for all reading Christians to use," "He was greatly pleased especially with 'The Small Pulpit' and with 'The Church and Service' ". As a result of the visits, reading rooms were started in several churches with new periodicals, such as the Nanking University Agricultural newspaper, Young People's Friend, Happy Childhood.

### Suggestions for another class.

Much of the material which we took was left with the churches. We sold several of our footballs at half-price in order that the most interested churches might continue the work started among boys. Some members of our group have suggested material that should be added on a future trip: more illustrated tracts and booklets to sell (it is not wise to give away too many tracts), more Scripture portions and small pocket Testaments, more sets of the citizenship and health charts, Christian Endeavor literature, better curriculum material for the Sunday School, cards for enlisting names of new enquirers, helps to prayer and manuals of worship, and more and better pictures and posters for use in preaching and speaking.

### The Return Trip.

The Return Trip was intensely interesting and profitable, but cannot be described in detail here. In Sutsien we visited the schools, churches and hospitals of the Presbyterian Mission. Members of our Band spoke in the church and schools, and the stereopticon pictures were shown twice. We were warmly welcomed in Tsingkiangpu and royally entertained in the fine hospital there. Here our group was asked to take charge of the mid-week prayer meeting, and members of the group spoke in the boys' school and in the hospital. During our day in Yangchow we visited all the Christian churches and schools and some government schools, and were entertained in the Baptist Mission hospital. Our group furnished a special program in the evening in the hospital chapel. Tsingkiangpu seemed to be a dividing line between the poorer north country and the more prosperous Yangtze River Valley. We were delighted to see churches built by Chinese funds and largely self-supporting in Sutsien and Tsingkiangpu, and the fine schools of the Baptist Mission in Yangchow.

### Some Impressions and Outstanding Needs.

The preachers we met varied greatly in training, ability and devotion. Some were passionately earnest in preaching and in their own prayer life. We will remember the young preacher at Mao-r-wo who rose long before daylight for his morning watch. In pastoral work we found some who visited often in the homes of all Christians and enquirers and looked up church-members who failed to come to church. The better trained men are generally doing the better work. But there seems to have been little training for building up a church and making it a transforming power in the community. There is little vision of Christian community service. The preachers' libraries are pitifully small and the preachers do little study and reading on the average. I quote a few of the comments from our group; "The preacher where I was did not seem prepared for his great responsibility and opportunity"; "The preacher's vision of work was very limited, he has no program for training of Christians and for children's work"; "He is not able to make contacts with the leading men of the town"; "He is oppressed by financial difficulties, the salary is too low"; "The preachers do not study enough."

In some places we found the teachers in the church's primary schools more alive to the needs of the community and more responsive to new suggestions than the preachers. Most of the workers felt that the church needed a broader program, but had no idea how to begin. Our feeling

was that all these workers would benefit by a year in the Nanking University Rural Short Course and by special training institutes which will include courses in Religious Education, Improved Agriculture, Rural Community service and Primary School methods. Most of the preachers can preach earnestly, but few are skilled in personal work with various types of individuals.

### Wanted: Real Rural Schools, not Struggling Imitations of City Schools.

The church's primary schools are furnishing education for many who would not otherwise receive an education, and are an important phase of the church's work. But equipment is very limited and teaching methods poor. Why could not the church take the lead in furnishing a type of life from which they come and promote real rural schools, not struggling imitations of city primary schools?

### Service Projects for Christians Needed.

As to the Christians we met, one of our group has summed up his general impression, "Religious life strong, generally honest, very poor, very polite." We all felt that there were many unintelligent and many inactive church-members whom a vital program of personal work and Christian teaching might change into Christian forces in the community. Comparatively few women and few of the more educated class are being won to the church.

### The Greatest Needs of Rural Life.

"What did you feel were the greatest needs of rural life?" our group was asked. "More education and guidance to raise the standard of living and thinking," "material and spiritual help," "improved agriculture," "more and better rural schools," "hygiene, roads, popular education."

### The Vision and Task of the Church should take in All Human Need.

All of us felt that the Christian church has a magnificent opportunity to help meet these material and spiritual needs. But "the church's program now is too cut and dried and poorly adapted," "the preachers are unable to meet the great opportunity," "the program is now too narrow, no religious education, no special work for children, no women's work, no contact with the gentry," "the church should emphasize personal work more," "With Christ and His Cross as the center, we should enlarge the vision and task of the Church to take in all human need."

### Outstanding Impressions.

In answer to the question, "What was your outstanding impression?" some of the replies were: "The lack of work for women and children," "one preacher had two churches, one flourishing and the other weak; the flourishing one had a group of earnest, active church-members," "the opportunity for children's work and the lack of leaders," "poverty and the economic problem of the people and of the church," "the importance of personal work and of lifting the standard of living," "would I be willing to serve one of those poor churches, and, if so, what would my program be?"

### Personal Evaluations.

"What was the greatest value of the trip to you?" "I realized better my own deficiencies. I know rural needs better and the importance of the rural church. The trip was certainly worth the time and money spent." "The trip helped me to know the real life of the people." "What I learned of rural life, customs and of the rural church will be a guide to me in my later work." "The experience was a great inspiration and I have much more sympathy with the common people." "The practical experience in Religious Education was of great value." "I learned humility and cooperation." "Although we went to preach Christ and to give a message of life, we all felt that we gained in vision and experience and in our own spiritual lives far more than we gave." The group returned to Nanking with something of the joy of the seventy whom Jesus sent forth.

### The Program of the Rural Church—Some Suggestions.

As to the program of the rural church, we believe that the following should be more emphasized: ruralization of schools, improvement of rural life, more homiletic and educational preaching, a strong program for the children of the community, the employment of women as well as men workers, more personal effort to reach the higher classes of the community, and the constant training of Christians and enquirers in Christian knowledge, home education and Christian service.

### Staffing the Field—A Needed Experiment.

After our experience, we discussed several times possible changes in the policy of rural evangelization which might hasten the winning of rural China for Christ. All of us were impressed with the zeal and consecration

of missionaries like Patterson and Dr. Junkin and with their preaching passion. But we are sure that the country will never be evangelized by missionaries alone, nor by low-grade paid preachers. Most of us are convinced that it would be the better plan to subsidize local churches, preachers and teachers less, or possibly not at all, and to spend the mission funds on a better trained staff working with the missionary to supervise the whole district. The money for a new missionary might be spent to secure such a staff of say six men—one agriculture expert, one educational supervisor, one promoter of Religious Education, two evangelists, one business manager. For the leadership of the local churches we would depend on the voluntary work of Christians or upon the preacher also if the church could afford to pay for his whole or part time. But this better trained staff would spend most of its time going from church to church and promoting work which the local Christian group could carry on. Perhaps we are too inexperienced and this is a wild scheme, but we would like to see it tried!

### Field Trips should be included in Seminary Curriculum.

We have some suggestions also as to the future field work of the Seminary. We would like to see such a trip as we made this spring a definite part of the curriculum, perhaps a little earlier than the last term. Points nearer Nanking might be selected. There should be careful preparation for the trip in connection with all the courses which the class is studying. Different members of the faculty from year to year should accompany the groups. Such trips will not only be of value to the students, of greater value than any mere observation trip, but will also bring the Seminary closer in touch with needs of the Chinese people and with the problems of the church. There should be a definite appropriation in the Seminary budget for such field trips.

We would also like to see the daily "Laboratory work" of Seminary students organized more thoroughly, so that students will have training and experience in various types of Christian work before graduation.

### Prospective Rural Workers should have some Agricultural Training.

We believe that every student planning for rural service should have at least a year of training in the College of Agriculture and Forestry. It is not so important for him to become a skilled agriculturalist as to get the rural viewpoint, to understand rural needs and life and to know how he can be a connecting link between community needs and expert agricultural knowledge and skill, between poverty-oppressed farmers and

letter seed and plows for example. Such service is a gateway to the Kingdom as truly as medicine or education. The eyes of rural workers should be opened to its possibilities.

#### **An Extension Department Recommended for the Seminary.**

We also offer the suggestion that the Seminary organize an Extension Department, similar to that of the Nanking University College of Agriculture and Forestry, to bring the work and contributions of the Seminary in closer contact with the needs of the Chinese church.

#### **Conclusion.**

In conclusion, I would like to quote the closing words of one student's report to his fellow-students, "These poverty-stricken farmers, these illiterate but lovable children, these terrible bandits, these dull church-members, these unenlightened girls and mothers, these poorly trained Christian workers are not people of another country. They are our brothers and sisters. They are China. Do we care about them, do we love them, are we willing to serve and sacrifice for them in the name of Christ?"

#### **PREPARING FOR THE TRIP.**

It may be of interest to some who would like to lead college or Seminary groups in similar field trips to know how we prepared for this one.

#### **Cooperating agencies.**

There are many agencies which can be of service in furnishing equipment, literature and suggestions for such trips. Among those which helped us were:

1. Nanking University College of Agriculture and Forestry which loaned us pictures and charts, gave us sample packets of their literature and newspaper for distribution in churches and gave invaluable suggestions out of their wide experience and deep interest in the rural church problem.

2. National Committee of Y.M.C.A., Department of Education for Citizenship, gave us the benefit of their experience in organizing lecture groups and deputations and sent us several copies of a pamphlet on Christian Citizenship Chatauquas prepared by Dr. Herman Liu. We also bought from them sets of their popular Citizenship charts and pictures.

3. Council on Health Education. From them we secured sets of Health posters and several thousand of the most inexpensive illustrated health tracts to distribute in schools.

4. Sunday School Union. Mr. Tewksbury generously sent us a large package of Sunday Union posters and 15 packages of selected books on Sunday School work and teaching methods to give to pastors and Sunday School superintendents.

5. Daily Vacation Bible School Movement. Mr. H. Eugene Davis sent us twenty sample packages of D.V.B.S. literature and pictures to use in promoting the schools in the churches which we should visit.

6. The Stewart Evangelistic Fund gave us several thousand of their tracts illustrated with Bible pictures and a large number of posters. They promised us a box of Scripture portions but the consignment failed to reach us in time.

7. The Women's Christian Temperance Union furnished us with some charts and literature.

8. The National Christian Council prepared for us packets of literature on the Rural Church to give to preachers and teachers.

9. Christian Literature Society and Religious Tract Society. Tracts and pamphlets to give and to sell.

10. The Nanking Y.M.C.A. loaned us a stereopticon and slides on Citizenship and the Life of Christ.

**Other Equipment** which we took included a portable gramophone (among the records were Chinese hymn records sung by Theodore Tu), seven inexpensive footballs which the Seminary has been using in its boys' clubs, thirty hymn books, and a box of First-Aid medicines and bandages.

#### **The Field Trip as a Class Project.**

With this general plan in mind, the B.A. III Class took the trip as a definite project in connection with our Religious Education course for the year. Class periods for two months were spent in planning, discussion, study of rural problems and preparation of material. A great deal of outside study and research was also done. Each discussion period began with a few minutes of devotion led in turn by the members of the class, for we all felt the need of divine guidance and power. And this spirit of prayer continued throughout the trip, knitting the group together with one enthusiastic purpose.

Each member of the class brought in his suggestions for the program of the two weeks. These suggestions were put on the black-board and criticized, modified or accepted. The plans for the first week included: preaching to adults, both Christian and non-Christian audiences; object sermons; talks, stories and songs for children's groups; general talks on popular education, Christian citizenship, health, etc.; special music, gramophone, accordion and group singing; stereopticon lectures; religious drama; distribution of tracts and gospels; exhibits of pictures and preaching from pictures; visitation of gentry and schools. What we had in mind for the first week was to reach as many people as possible in concrete and appealing ways with the Christian message. For the second week we planned intensive personal work among Christians and influential non-Christians, a training class for church members, and an emphasis upon religious education and Christian community service. We realized that any program we might make would have to be adapted to many unforeseen local conditions, and that we were going also as learners. Much has been said and written in recent years about the importance of the rural church, but none of us knew its problems first hand. All of the students are preparing for positions either in cities or in towns. Of the life and needs in the famine-swept, bandit-terrorized, poverty-stricken "north country," we knew little. A Conference for Christian Rural Leaders, promoted by Nanking University College of Agriculture and Forestry, was held in Nanking, February 2-5 and our group attended all the sessions with great profit.

#### Organization of the Class—Gathering Material.

In order to facilitate the preparation for the trip, the group elected officers and committees. A Committee on Illustrative Material secured charts and pictures which might be used in preaching and speaking to schools. A Committee on Literature suggested a study of available tracts published by various Literature Societies with a view to selecting the best kinds for the trip. Several literature societies furnished sample tracts; these were pasted in one large book. The study of them and selection of the most suitable was most interesting and educative. It was suggested also that each member of the group take a dollar's worth of books to the pastor of the church where he would spend the second week, and the selection of these books after study of bibliographies and of books in the Library and Seminary Bookstore was another helpful side-project. The Music Committee selected two hymns to Chinese tunes from Pastor Swen's Hymnal, and a thousand copies each of these were printed to be

taken with us. Several in the class are good singers and special group and quartette music was also prepared. One member prepared for publication a brief tract which included a statement of our aims, a verse of Scripture and a stanza of a hymn. Two thousand copies of these were printed and were very useful on our trip as a sort of card of introduction. Another committee worked on suggestions for a religious message in some dramatic form. To help us in our study of the rural church, rural survey blanks such as are prepared by the Nanking University College of Agriculture and Forestry were secured for each member, and the class also prepared a briefer form for recording data about the economic, social and religious conditions of the rural communities we were to visit and about the work and problems of the rural churches. The class also assisted in preparation of a printed leaflet for use in training classes for volunteer workers, "A Brief Introduction to Religious Education." This makes a strong plea for a strong program of Christian teaching and Christian service in every church, discusses briefly some important principles of teaching and suggests ways in which the church may reach more effectively the children, youth and adults of its schools, homes and community and guide their religious experience.

Each member prepared in advance several sermons for Christians, for non-Christian audiences, for gentry and student groups, and gathered material for talks to children. Although most of these sermons were never preached just as prepared, the time spent on them was not in vain, and our experience in the country field not only tested and modified this material but also drew on all our available resources and gave us many new thoughts for preaching and teaching the gospel. Another value of this preparation was that it linked our project with other courses which the class was taking,—Homiletics, Apologetics, Theology and such. Professor Stanley Smith spent some time discussing with the class what should be the main emphases in rural preaching.