

the Philippines on a scale of 1 : 7,500,000. The coast-line, rivers and lakes are in blue; the railways and sea-routes, with distances, are in red; and town names are printed in black. The general effect is excellent, and the map should meet the needs of the class-room satisfactorily.

LETTERS TO THE EDITOR.

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Forests and Floods.

SOME time ago the question of the effect of forests in checking floods was discussed in the pages of NATURE. The subject was lately recalled to my recollection while watching gardening operations in the vegetable borders. I was then much struck by the different conditions, after rainfall, of newly dug ground and ground that had lain undisturbed for a year. The gardener was proceeding to put in plants in the newly dug part, but found it much too wet to be worked in. It was suggested he might continue the digging of the rest of the border and leave the planting until later. On breaking up the undisturbed ground, it was found to be fairly dry and in quite good condition for digging. These conditions seemed to indicate that newly disturbed ground holds a much greater proportion of the rainfall than does consolidated ground in which the soil particles are more closely packed together. In the latter the water seems to pass much more freely through it than in the former, possibly due to there being a continuous water film from the surface to the water table. It not only passes more quickly to the lower level, but much more of it passes, while the disturbed ground retains a much greater proportion of it to the benefit of the vegetation.

Experiments might be made to get further information on this point by means of proper water-tight tanks filled with earth, and comparative readings taken of the drainage water in tanks in which the soil had become consolidated by rainfall and those in which the soil had been recently disturbed. As this would take a long time to accomplish, it has not been done, but perhaps some others may be induced to make the tests, as the knowledge of the subject may be useful in agricultural operations. It does not directly bear on dry farming, as that is a question mostly of surface soil mulch produced by stirring the surface soil and so breaking the water film connecting it with the subsoil. But it would seem to indicate that before dry farming can be started, the surface soil, to a depth sufficient to hold the rainfall, should first be thoroughly pulverised to prevent the rainfall passing downwards and beyond the range of the roots.

Though satisfactory tests have not been made yet I had an opportunity of making some experiments on somewhat similar lines. There were three pots full of soil lying out in the garden. These had previously been in use in some experiments with plants. The soil in all of them was alike, having been taken from the kitchen garden. These pots and soil had been lying out for more than a year; and as the soil in them was thoroughly consolidated, the question was put to them. First, the pots were all weighed; as the weather had been fine for some time, the soil was

pretty dry. The pot having the medium weight was then selected, the soil emptied out, broken up, and returned to the pot. Water was now poured slowly over the soil in all the pots in 4-oz. doses at a time. The first thing noticed was that the water entered the soil of the undisturbed pots more slowly than the other, and, secondly, that the water came more quickly through the soil in these pots than through the other. Water was added to the pots until they ceased to take up any more. After draining, they were weighed again, and the result is given in the table:—

Weights in Pounds and Ounces of the Three Pots.

	No. 1. Consolidated soil		No. 2. Pulverised soil		No. 3. Consolidated soil	
	lb.	oz.	lb.	oz.	lb.	oz.
Dry	7	9½	7	10	7	13
Wet	8	10	9	6½	9	1
Water held by soil	1	0½	1	12½	1	+

It may be further mentioned that it was thought that some of the soil in the consolidated pots might not have got thoroughly wetted, owing to the water running quickly through them; the three pots were therefore afterwards put in a vessel of water to soak; they were then drained and weighed, but the result showed but little change, showing that all the pots had got as much water as the soil would hold. An examination of the above table shows that the disturbed soil holds a much greater amount of water than the consolidated soil. No definite conclusion can be drawn from these figures as to the relative retaining powers of the soil in the two conditions, as no two soils are likely to be equally affected. The only thing to be noted is that the pulverised soil has a much greater power of holding water than the consolidated.

It may be asked: what has all this to do with forests and floods? If we are correct in supposing that soil by becoming consolidated and the particles close packed, by the action of the rainfall, causes it first to resist the entrance of heavy rainfalls, and secondly, after it has entered the soil, to facilitate its passage through it to depths beyond the range of being of use to vegetation. If this be so, then anything that breaks up the close packing of the grains and stirs the soil will tend to enable the water to enter the soil, and will also tend to enable it to retain it. Now the roots of trees in forests, by their constant growth and expansion, stir the soil and prevent it getting consolidated. The soil under trees will therefore always be in the best condition for absorbing and retaining the rainfall. And the surplus is only slowly parted with to feed the drainage, whereas on bare soil, or soil on which the vegetation is poor, tends to reject the rainfall, causing the water to run off the surface, and what enters is quickly passed downwards to swell the drainage water. From the above it would appear that bare and poorly cultivated land will tend to cause floods by speedily getting quit of its rainfall, while forest land will retain and only slowly part with it. The decaying vegetation on the surface under trees has also a beneficial effect, as it absorbs water and acts as a mulch, preventing drying.

It is well known that rains in early summer, unless when torrential, give rise to small amounts of flooding compared with winter rains of the same amount. There are a number of reasons for this which our space does not admit of treating, but it is probably in part due to the stirring action on the soil of the roots of grasses and other plants, as that is the season when root action is most active.

Ardenlea, Falkirk.

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