

Flood Recovery for cropland

Repairing Flood-Damaged Farm Fields

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Farm fields that have been covered with flood waters may need structural (physical) repair before returning to full production. Flood debris, sand, silt, erosion, and loss of soil structure may all result as residual effects of flooding.

Before You Begin

Erosion caused by flooding may have removed soil cover over buried utilities such as gas, electric, and communication lines. At least two days before any excavation or deep tillage, contact your utility locator service to locate and mark underground utilities. Contact Iowa One Call at (800) 292-8989 or Nebraska Digger's Hotline at (800) 331-5666.

Debris Removal

Flood waters will leave drifts of plant debris and driftwood behind. Other items such as building materials, furniture, barrels and tanks, and assorted garbage may be included as well. As soon as soil conditions allow, begin taking inventory and perhaps even map on aerial photos where debris accumulations are located. Note any potentially hazardous items such as fuel tanks or unmarked containers. Household hazardous materials (HHM) should be separated and stored safely for proper disposal. For details, call the Iowa Department of Natural Resources at (712) 243-1934 or (712) 328-4985 in Iowa or call the Nebraska Department of Environmental Quality at (402) 471-2186 in Nebraska. EPA is taking responsibility for orphan tanks and drums (fuel and propane tanks). For directions and assistance, call (515) 281-8694 (spill hotline).

Plant debris (free of other trash) that is less than 4 inches deep can likely be incorporated into the soil with tillage. Consider the additional nitrogen demand caused by decomposing plant debris in the soil. When plant debris is more than 4 inches thick, it may be necessary to spread it to a thinner layer before incorporating. Residue too thick to incorporate may have to be removed and/or burned.

In Iowa, flood debris including plant residue, trees, and building materials can be burned in farm fields as long as tires, asbestos, and asphalt shingles are removed. In Nebraska, debris and buildings can be burned on farms after asbestos, furniture, household garbage, and any other potentially hazardous materials are removed. Nebraska rules require that ash from burned debris be hauled to an approved landfill for disposal. Burial of unburned debris is allowed on farms as long as it remains above the water table and does not pose an environmental risk. For more detailed information on burning or burying debris, contact the Nebraska Department of Environmental Quality or Iowa Department of Natural Resources at the numbers listed above.

Keep safe separation distances and fire safety in mind, and allow adequate drying time before attempting to burn debris. Follow underground utility guidelines mentioned above before digging holes to bury ashes or debris.

Both Nebraska and Iowa prohibit pushing flood debris back into rivers.

Sand Removal

As with debris, flood waters may deposit large amounts of sand in farm fields. Sand drifts will likely be deepest near broken levees where water velocity decreased rapidly, and may be several feet deep. Mapping the extent of sand deposits on a soil map or aerial photo can help you determine appropriate movement and spreading strategies. Using a soil probe, tile probe, or any other slender rod may help quickly determine sand depth.

When sand deposits are thin, they may be successfully mixed into the soil with tillage equipment. Deeper deposits may require spreading or removal. Allowable sand depth for mixing into the soil depends on the underlying soil type and tillage method, but these guidelines should be appropriate for most Missouri valley, Iowa and Nebraska river bottom soils. Refer to the soil survey for your county to determine actual soil types (soil map units) in your fields.

- **Sand less than 2 inches deep:** Let normal field operations incorporate this sand.
- **Sand 2-8 inches deep:** Incorporate sand into underlying soil with a chisel plow, moldboard plow, or other aggressive tillage tool. Depth and aggressiveness of tillage required will vary with the depth of sand and texture of the underlying soil. The goal is to achieve a modified soil that still has adequate water holding capacity in the root zone.
- **Sand 8-24 inches deep:** If possible, spread this sand to areas with less than 8 inches of sand and treat it as mentioned above. If the extent of the deep sand is too large to spread to less than 8 inches deep, treat the area as mentioned below.
- **Sand more than 24 inches deep:** Evaluate the cost of moving the sand to waste or stockpile areas. Consider the relative costs of moving the sand and of abandoning the crop area. Note that sand may be moved to field border areas, but water quality rules prohibit pushing sand back into a river.

Before beginning tillage or sand moving efforts, closely evaluate the moisture condition of the soils. Flooded soils can be slow to dewater and dry. Some areas of the field may need more time to dry before tillage or traffic. If heavy traffic (scrapers, trucks, etc.) is planned, try to limit the heavy traffic to controlled lanes which can be deep-tilled to repair compaction.

If a field included any wetlands or farmed wetland areas prior to flooding, be sure to talk to your Natural Resources Conservation Service (NRCS) office prior to moving sand in that field. Regulations may require special provisions or protection for those wetland areas.

Deep tillage tools are available for inverting soils to depths deeper (4-5 feet) than reached by moldboard plows.

The cost and availability of these types of equipment may make sand removal more practical than extra deep tillage. After the 1993 floods, the cost for custom tillage with this type of equipment in southern Missouri ranged from \$300 to \$600 per acre (1993 prices).

For silty clay loam soils, tilling sand in to a depth at least 1.5 times the original sand depth is recommended (e.g., use a 9-inch tillage depth for a 6-inch layer of sand). Sandy soils may require tillage to a depth of twice the sand depth or more for satisfactory results.

Following sand spreading and tillage, be sure to soil test the field. Testing separately from areas with different amounts of sand incorporation may be appropriate to account for nutrient deficiencies of the sand. Adding organic matter may be beneficial to soils where large amounts of sand are incorporated. Compost and manure are excellent sources of additional organic matter.

Gully Repair

In areas where water velocity was higher, erosion may have occurred. Shallow erosion of less than one foot may be repaired with tillage on deep river bottom soils. Deeper erosion repair may require earth moving equipment. Be cautious about using debris sand in filling deep erosion channels unless adequate depth of quality soil can be placed over top of the sand fill. Again, water holding capacity of the finished soil is the primary concern. Soil testing and proper fertilization of the finished soil is also important.

In some cases, severely eroded areas may be too expensive to repair. Selective abandonment of small areas may be a more logical choice. Land easement program options may influence the economics of this choice.

Land Leveling

In some cases, the use of flood irrigation may require much more precise land leveling as part of the field repair. Refer to flood irrigation materials for advice on these situations.

Fertility and Soil Health

As mentioned, soil testing is critical for good management following the physical repair of flooded fields. Consider grid sampling or sampling by soil map unit and area of greatest sand addition to identify specific areas of need. Refer to agronomic bulletins or your agronomist for specific fertility advice.

Soil microbiology can also change during and after flooding. Refer to the bulletin in this series on *Flooded Soil Syndrome* for discussion of this topic.

Compaction

Some people assume that the weight of flood waters can lead to soil compaction. The weight of the water itself does not lead to high soil pressures (5 feet of water equals 2.2 psi). The fact that soil pore space may be filled with water during flooding adds to the resistance of the soil to compaction. Even sand deposits, while more dense than water (5 feet of sand equals 4.2 psi), do not cause high pressure on the soil. However, loss of soil structure may cause effects on the soil surface similar to soil compaction.

Prolonged exposure to water and wave action may destroy the soil structure marked by aggregation and soil porosity. Submerged soils may develop a layer of very dense consolidated silt that is resistant to water infiltration and plant penetration. This effect is often visible in the bed of a dry pond or lake. While this is technically not the result of soil compaction, the effect can be similar. Given adequate drying conditions, this layer will likely dry, shrink, and crack. If the layer is only one or two inches thick, tillage and subsequent weathering and biological activity should return the soil structure in time. In severe cases, deep tillage and more time may be required.

Documentation

In cases where insurance or other assistance programs may provide financial reimbursement, it will be important to document restoration expenses. Keep receipts for all purchased materials, supplies, and services, as well as records of your own labor.

Resources

Repairing Flood Damaged Fields. Technical Notes, Agronomy #22. USDA Soil Conservation Service, November, 1993. <http://efotg.sc.egov.usda.gov/references/public/IA/AgronomyTECHnote22.pdf>

Soil Testing Following Flooding, Overland Flow of Waste Waters and other Freshwater Related Disasters. T.L. Provin, S.E. Feagley, J.L. Pitt, M.L. McFarland. Texas Cooperative Extension SCS-2008-07 <http://varietytesting.tamu.edu/criticalinformation/Freshwater%20flooding%20soil%20testing%20issues.pdf>

Iowa Department of Natural Resources Guide to Flood Clean-Up in Rural Areas. <http://www.iowadnr.gov/portals/idnr/uploads/files/disaster/agcleanup.pdf>.

Nebraska Department of Environmental Quality Flooding in Nebraska: Environmental Guidance. <http://www.deq.state.ne.us/>.