Soil covered terrain - Terraforming

A guide on realistic terrain shapes

How terrain is shaped in real world

All terrain starts with tectonic processes. Earth plates shift, collide and break up. These processes create the very large scale structure of terrain. Also detail structures are affected by the folding and arrangement of geological layers (vertical or horizontal).
For most terrain shaping in real world erosion by water is the dominant process. Exceptions are nival regions of mountains and deserts. The basic rule for this process is that at steep areas the water will flow quickly and drag away materials and at flat areas the water will be slower and deposit those materials.

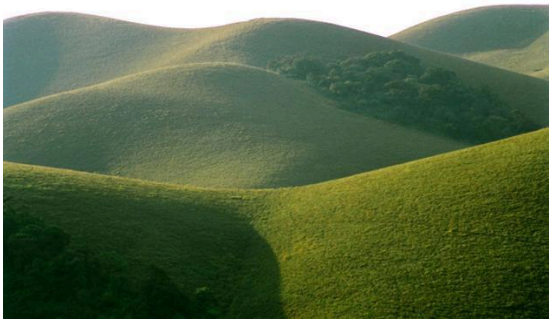
Soil layers

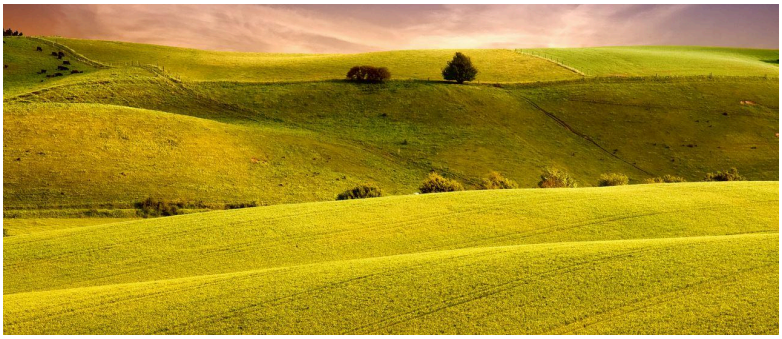
This guide focuses on soil covered terrain in contrast of bare rock terrain. Soil originates from deposited (by water) material. The upper layer is more or less blended with decayed plants parts (humus). Width of soil layers vary from only a few centimeters to several meters. Bare rock areas are very rare on earth I would guess that at least 99% of dry surface of earth are soil covered.

Terrain shapes

Most important result of the shaping by water is that there are **no depressions** in terrain (except of rare exceptions like karst regions). Rainfall is gathering at low areas forming small streams running down hills merging into rivers flowing into the sea (or occasionally in large inland lakes). Wherever tectonic processes form a depression, water will fill it with eroded material and/or erode a valley out of it.

Mostly the upper soil layers are very soft, usually a mixture of loose sediments and humus. This material is easily flattened and smoothed by rainfall, wind and growing plants during many, many years. The result are very regular shapes. The inclination of hillsides doesn't change erratic but gradually.





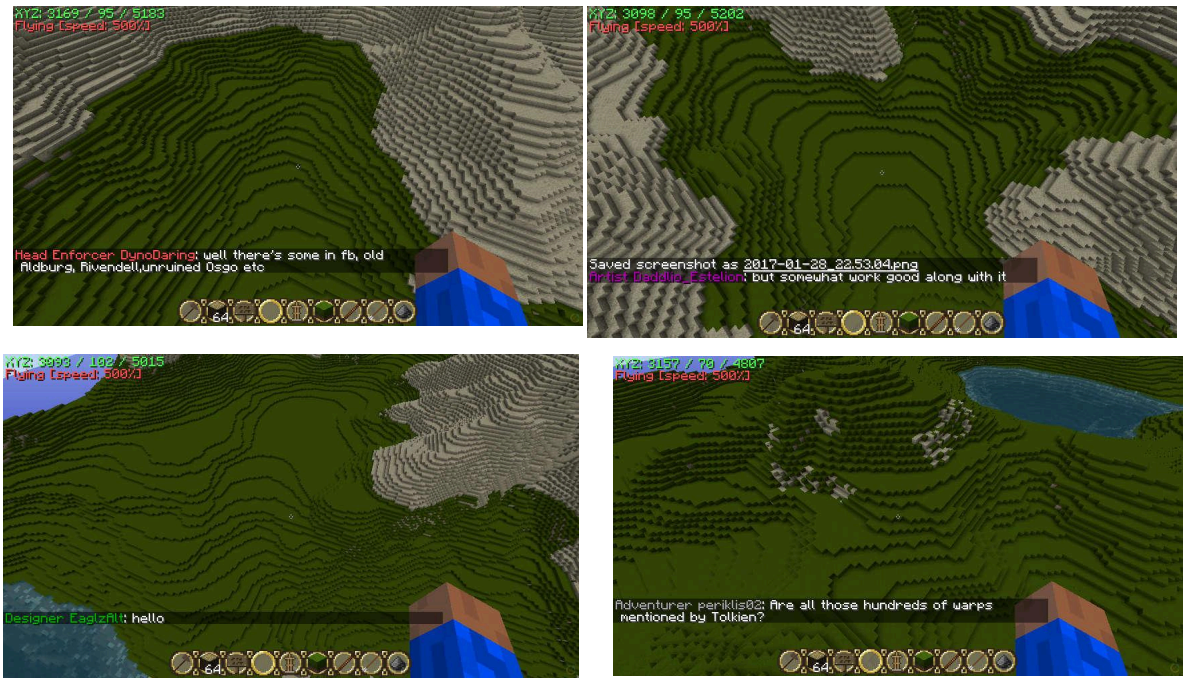
Quite often all hillsides of an area have almost the same, constant inclination.

With larger height differences in an area the shapes become less smooth. The ridges and ravines become more angular. But the hillsides are still very uniform.

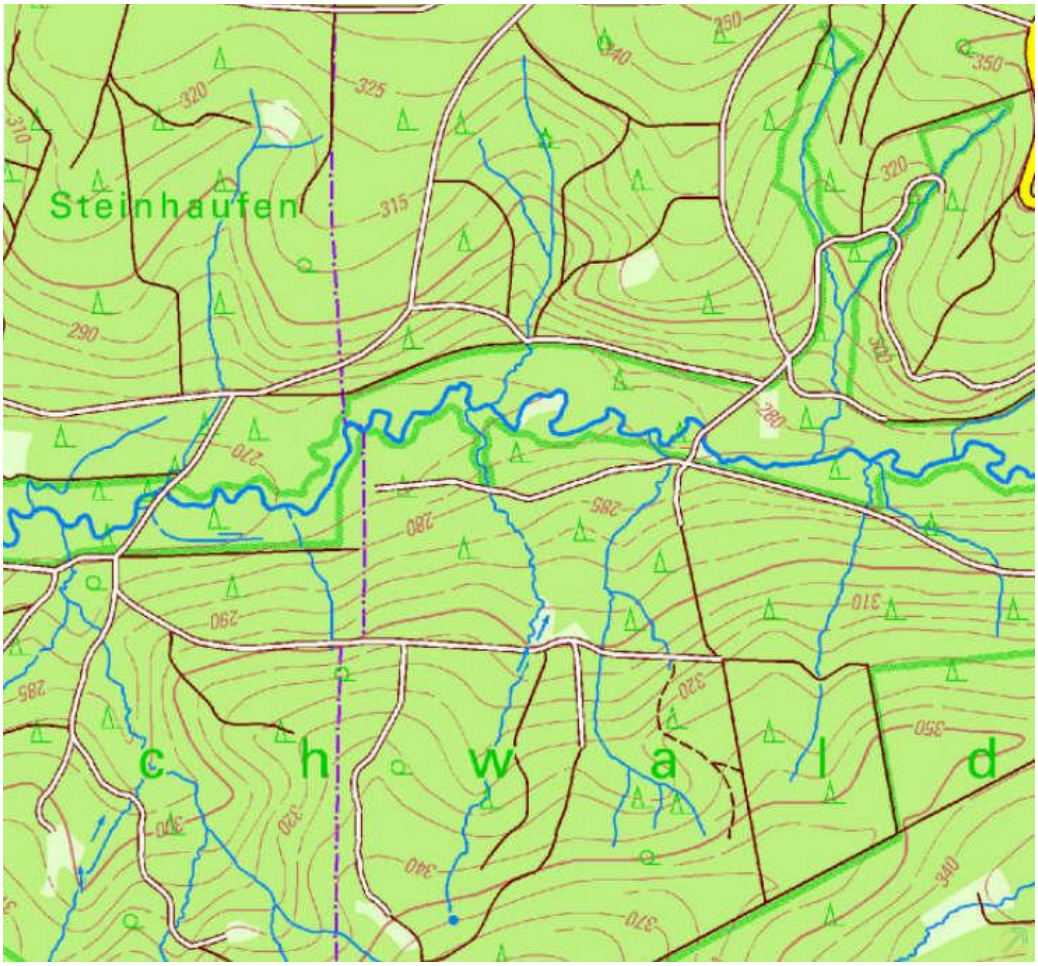
If all soil is eroded and bare rock is exposed the shapes become much more irregular and random.

Soil covered terrain in minecraft

Unfortunately making smooth, uniform shapes in minecraft is a lot of work with voxel. Usually terrain shaped with voxel looks quite irregular. The individual terrain level tend to be angular instead of smooth and often nearby terrain levels are quite different from each other.

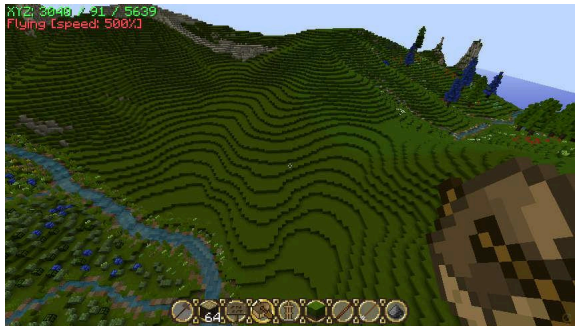


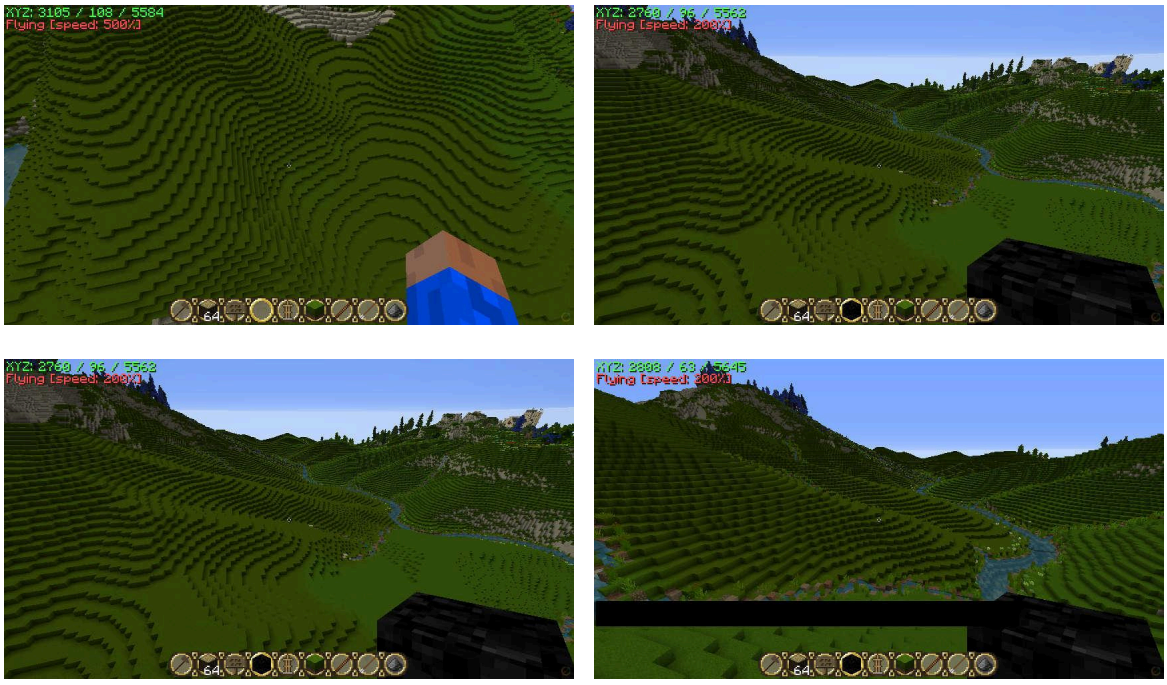
In contrast look at a real world topological map of small stream between hills covered with forest:



Individual contour lines on this map are very smooth except of a few places, mainly where small streams digging ravines into the hillsides. Also nearby contour lines have very similar shape. Third the inclination (distance of nearby contour lines) of the hillsides change gradually only.

There is already a lot of terrain in Belfalas like this:





How to make this in minecraft

Smooth terrain is a lot of work. The more irregular terrain at the first screenshots is a good start., but better turn it into sand again. Possible way to smooth the terrain is switching between **/b e melt** and **/b bb** with repeatedly with smaller brush sizes each time (**/b 15** - **/b 10** - **/b 4**). Last and most time consuming step is **/b bd** with brush size 4. Afterwards the sand is turned to stone and covered with gras.

Again the rules for smooth terrain:

1. Mostly smoothly bending terrain levels (avoid diagonal lines of blocks)
2. Very similar shape of nearby terrain levels
3. Similar width of nearby terrain levels