

Keyline uses cultivation, irrigation and stock management techniques to greatly speed up the natural process of living soil formation. Conversion of subsoil into top soil may, under natural conditions, occur at 10 to 15 tonnes per hectare each year. On Keyline farms, during the conversion process, this figure may increase beyond 10 to 15 hundred tonnes per hectare each year. The numbers may be surprising but annually deepening the topsoil by 10 to 15 cm (i.e. 4 to 6 inches) achieves this result. It is a practical short term goal to deepen the living top soil to 30 and 45 cm (twelve to eighteen inches).

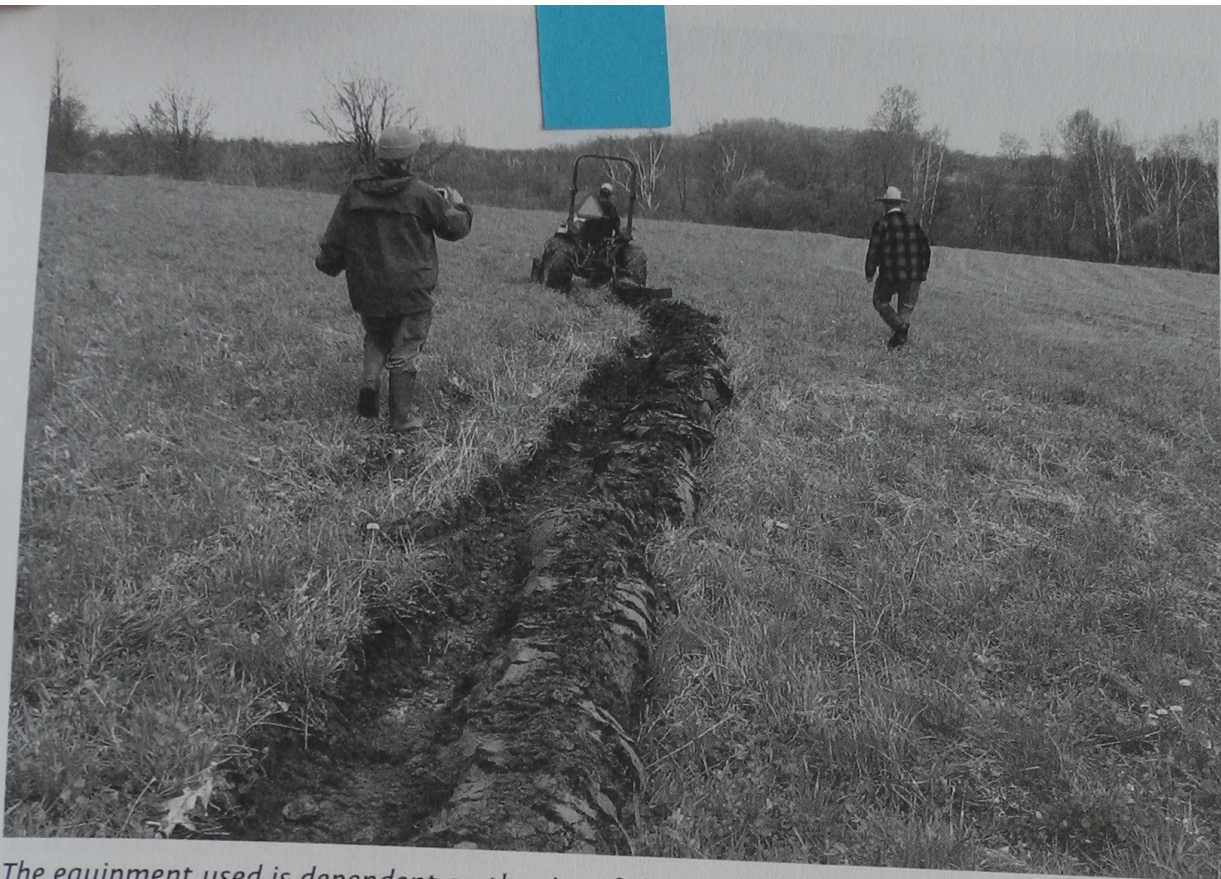
*Ken Yeomans, Keyline Designs*

When I had first read Yeomans' text on keyline designs nearly 20 years ago, I pooh-poohed the idea that topsoil could be created that fast and from the top-down. After all, I had learned (by reading books and devotedly making compost) that topsoil was created from the top *up*. The logic was that plants and animals died on the soil surface and the cumulative effects of their piling higher and deeper, was a slowly deepening layer of topsoil. Also having watched mosses and lichens grow on rocks and slowly accumulate an incredibly thin and delicate soil layer, I could appreciate



*On this 5-acre site the keyline swale moves water from the wet valley to the drier ridge. It really does work!*





*The equipment used is dependent on the size of the site and the soil permeability. It can range from shovels and hoes to bulldozers and excavators.*

how important our soil is and the need to conserve it. Having made literally tons of compost by hand and yearly hauling it to garden beds in a wheelbarrow really drove home how important topsoil is and how much work in lifetimes it takes to make — especially when the effects of the compost seemed so fleeting and insignificant.

The idea that soil could also be built from the top *down* was a somewhat radical thought that I believed was being promoted by crazy people trying to sell expensive equipment. In 1996 we laid out our entire farm in southwest Wisconsin using keyline principles, but because at the time I believed that soil was built from the top *up*, I knew that keyline subsoiling would not be necessary. It would merely be extra fuel wasted driving around pulling a silly hook for no apparent economic return.

It was a fluke that I later discovered an old single-shank subsoiler in the front yard of a friend's farm. A planter box full of purple flowering lobelia spilled out over it and geraniums and marigolds flocked around it in apparent utter adoration of this ancient rusty hulk. I asked my friend if it worked and he said that it had when he parked it there before his ma planted flowers around it. I asked him if I could borrow it and he said, "Yes." Here it is nearly 15 years later and I have yet to return the subsoiler back to him!





*Keyline swales, berms and pocket ponds capture and spread out all rainwater while allowing access for vehicles, water lines, and livestock fencing while creating a beautiful, functional farming landscape.*

The first time I used the device it would barely cut one foot deep into the hard clay soil. The tractor labored in low gear and I was frequently jolted to a stop as the hook dug deeper, beyond the capacity of my 35-horsepower tractor to pull it. I would have to shift into reverse, raise the hook and back it out of the slot then move forward and try again. Whenever I would lift the hook at the end of each pass (at row end), it would be weighed down, covered with yellow or red clay, depending on what was down there. Back in those days I carried with me a square-nosed shovel that I used to scrape the clay from the hook before I set it down again. If I didn't remove the stuck-on clay, the large soil lump would prevent the point of the subsoiler knife from diving down into the earth.

Through the years I've continued the practice of annual subsoiling, in my mind mostly as a water harvesting technique. I could see with my own eyes during every rain the vertical puddle that formed two inches wide by several feet deep extending down into the ground.

I knew that I was taking water that formerly would have run off and I was storing it in the soil. That was a good enough reason for me to keep doing it.

As the time passed, though, I noticed that each year the subsoiler seemed to cut deeper into the soil than ever before. I also noticed that when I lifted the hook I no longer had wet, smeared, sticky potter's clay adhered to the



tool, but an increasingly darkening loam that would crumble off on its own. This past spring, after nearly fifteen years of continuing this practice only *once* did I pull up the hook and see anything other than a rich, dark soil. By building berms and swales and by doing annual subsoiling parallel to those berms and swales, I captured the water that falls on our site. I can move the water from areas of surplus to areas of deficit. By doing annual keyline subsoiling we can increase the thickness of the topsoil layer on our farms from the top down. Increased topsoil means increased moisture and nutrient retention which leads to increased productivity — yet another virtuous cycle.

These simple techniques are part of the toolkit that restoration agriculture farmers use in order to restore degraded landscapes and to increase the fertility of farmed-out lands. For the restoration agriculture farmer, understanding keyline design should be a top priority.

For more information on keyline water management I highly recommend going directly to the source and obtaining a copy of P.A. Yeoman's book, *Water for Every Farm: Yeomans Keyline Plan*, but be warned you may have to learn how to speak Australian.