



IT'S TIME THE SKY FELL

Grazing, carbon sequestration, fungus power and ranchers unite to save the world. Words and photos by Steven H. Rich.

Anyone who cares about global warming should know about pulse grazing because it's the only process that can be widespread and powerful enough to deeply reduce atmospheric CO₂. It is also capable of solving the accelerating global loss of soil, fertility and structure. Credible experts have calculated that increasing present world soil organic-carbon levels by a range of only 1 percent to 1.6 percent could sequester (take out of the atmosphere) the entire increase in atmospheric CO₂ accumulated since the dawn of the industrial era. One credible calculation says that Australia alone could do the job.

Here's how it works: visualize a three-year-old stand of a tall-grass species like tall blue stem, giant sacaton or Great Basin wild rye growing up to nine feet tall on three-foot centers. Since germination, each of these big plants would have pushed a root crown six to 12 inches deep with two-fifths the specific gravity of a plug of pine into the ground, connected to a massive and dense network of roots of various sizes up to nine feet deep. This represents a greater than 1.6 percent increase in soil organics. Periodic drought stress doubles water-seeking root-hair growth and soil-organism activity around these new roots. Then the new roots die if the soil continues to dry. Likewise, after each growing-

season grazing event or haying, a percentage of root tissues also dies. Seasonal dormancy also causes this natural and valuable response.

These processes prune grass roots, which react to the stimulus of adequate soil temperatures, moisture and available nutrients by quickly growing a mass of new roots to replace the dead ones. This growing back naturally places large amounts of atmospheric CO₂ in the form of fiber, starches, sugars, proteins and hydrocarbons into the soil each and every time it occurs. Carbon and nitrogen-bearing compounds continue to accumulate until some level of saturation is reached. In well-drained grassland soils, saturation is a very long way off. If practiced primarily to

sequester carbon, pulse grazing is a careful process of timing grazing (or haying) events to optimize rates of root death and replacement so as to stuff as much carbon into soils as possible.

For the purpose of rapidly increasing soil carbon, plants are grown tall and then grazed fairly short. Next, their regrowth is monitored and timed to let the plants fully recover before grazing prunes their roots again. Grasses are generally adapted very well to this ages-old carbon-pulsing cycle. This is precisely the process which created the dark grass-formed carbon-rich soils of the American Midwest, the Eurasian steppes, African savannahs, the pampas of Argentina and Brazil, and all other ancient grasslands of the world. Most grasses developed in relationship to seasonal migrations of grazing animals—more often than not in large herds—grazing competitively and severely.

By optimizing the pulse-grazing process, soils can be re-carbonized with relative ease and speed. Most Americans have been told in school that it takes 1,000 years to produce an inch of soil. This statement may be true if we are talking about the weathering of rocks into mineral soil. It misses the mark by close to a thousand years in reference to re-establishing the organic fraction of soil under good conditions. The soil has hidden talents.

For example, a wonderful but unseen symbiosis between grasses and arbuscular

mycorrhizal fungi completes a feedback loop between elevated atmospheric CO₂ levels, grass growth and soil carbon sequestration. USDA soil scientist Sarah F. Wright discovered a sticky glyco-protein named glomalin, which skips the long decomposition process and quickly slathers soil particles with stable liquid carbon compounds. The fungi pull in carbon-rich nutrients—eagerly donated by grass roots in exchange for minerals, etc.—and speeds up sequestration by years. These almost omnipresent fungi accumulate in massive tonnages. Their activities are crucial and account for at least 30 percent of soil carbon. There are reasons to believe that present lab methods grossly underestimate glomalin carbon storage capacity and—better yet—the higher CO₂ levels get, the more glomalin the fungi produce. In Wright's words, "You're in the driver's seat when you use techniques [like pulse grazing] proven to do the same thing as the CO₂ that may be causing global warming" (that is, make the fungi grow faster).

One pioneer of soil carbon re-establishment was the late Australian, P.E. Yeomans, the developer of the Key Line System of water and land management. He developed a tillage implement that mechanically and aggressively sliced off grass roots four inches underground, forcing regrowth. This also aerated the soil and increased water infiltration.

Those four inches became black, friable topsoil with five percent to eight percent organic matter within three years. This is several times the 1.6 percent top estimate to eliminate the CO₂ buildup. Yeomans succeeded spectacularly by forcing an explosion of root regrowth resulting in fungal, bacterial and other soil biota activity in his plant and litter-covered soil, with enough water and animal inputs like dung and urine. He started with hard clay. His work has been repeated worldwide. Pulse grazing works on essentially the same principles. It has the capacity to be used on most of the earth's surface, and it has been proven to both abundantly store carbon in soils and to create a spreading cascade of other wonderful environmental effects when practiced conscientiously, such as healthy watersheds, burgeoning wildlife, and a potentially stable rural, urban, and world economy.

If society and the environmental movement are serious about solving the buildup of atmospheric carbon, they should begin with by far the most muscular process of CO₂ reduction that humans can control, and stop fiddling with lawn mowers, motor vehicles and coal-fired power plants. University of



ABOVE: CO₂-sucking former "desert." Ranch planners chose this formerly eroding, low-production, eight-to-10-inch-rainfall, infertile, clay soil site (with a tiny remnant stand of introduced grass) as a "sacrifice area" for feeding hay to elk. Pulse grazed by cattle each year—after up to three months dormant grazing by more than 2,000 adult wintering elk—it exploded into an abundant grass stand. The combined practices increased grass production for up to a mile in every direction, from 50 percent to an estimated 2,000 percent. A carbon-rich topsoil layer quickly formed where none had existed. White-tailed prairie dogs have densely colonized the elk feed ground. Pronghorns and other wildlife see it as an ice-cream area because of the very nutrient-dense forage it produces. Every year it pulls in another CO₂ load.

BELOW: Unmanaged grasslands are much less nutritious for wildlife and sequester a small fraction of the carbon of those managed for pulse grazing. With each pulse-grazing event, roots grow back into a moister, more nutritious environment prepared by soil organisms. Grass plants ramp up growing processes—aided by symbiotic, glomalin-forming mycorrhizal fungi and bacteria. These are also part of the total soil carbon sequestered by a good grazing process. Grazed green pasture and gray, rested highway right-of-way at top of photo illustrate the difference between management and neglect.

OPPOSITE: The arrow is pointing from the sky to the ground. D'ya think someone is telling us something?



Minnesota Extension Service states that the present soil carbon pool (total carbon stored in soils) is "three times greater than the atmospheric pool and 3.6 times the biotic pool [carbon in living plants and other organisms]."

What all this means is that we could stop letting our forests burn up, thinning them instead, and manage them for multiple uses again. We could begin "slashing" (mowing and scattering) or pulse-grazing grasses and forbs on a biologically planned basis on mil-



This sage-steppe land was treated to create ideal sage grouse shelter/foraging habitat and ranch prosperity. Increasing grass and forb production also increases arbuscular mycorrhizal fungal biomass. These fungi facilitate grass growth and produce vast tonnages of glomalin—a carbon substance which stickily coats soil particles and wonderfully improves soils' water-holding capacity and structure. This symbiotic fungal-based liquid-carbon pathway quickly moves CO₂ underground and does a vast deal of other good.

lions of unused or undermanaged acres. This could be quickly accomplished. Australian farmers have developed exciting methods of in-seeding cool-season grains into stands of dormant but living and grazable native warm-season grasses, which doubles down on sequestration potential, profit and ecosystem health. Highway rights-of-way could be in-seeded with the tallest grasses the sites can support and mowed at optimum times. Ranches could be given incentives to change to biologically planned pulse grazing as well as to plant appropriate grasses in potentially productive locations.

The huge loss of herbaceous plants, especially grasses, along with soil and watershed values caused by the invasion of woody species in sagebrush and chaparral lands could be healed at last. Chaparral management by herds of goats—with the generally huge increase of native grass that accompanies planned chaparral harvest—wonderfully improves wildlife habitat. Restored spring and stream flows are a common result of reducing woody vegetation. This could be paid for just

by reductions in presently gigantic firefighting, property damage and habitat fire-damage mitigation costs.

Also, there is great potential in restoring productive grassland components to vast degraded piñon-juniper areas. Simply removing invading P-J has caused native-grass population explosions in areas with good rainfall and remnant grasses. Up to a ton per acre has sprung up during the first year or two, and root mass can be up to three times the mass of grass leaves and stems, with nearly half being periodically replaced due to pulse grazing.

Home owners could help soak up a lot if they would simply let turf-grass lawns grow twice as tall between mowings. This alone would cause the root zone to extend at least twice as deep and sequester millions of tons of atmospheric CO₂. Turf grass is this nation's largest crop. It also uses the most water, fertilizers and chemicals. Adding clovers and doubling the height before mowing (and soil-composting clippings in gardens) would greatly reduce water needs due to increased soil shading and improved soil structure.

Lawns are perfect places to grow black, carbon-rich soils. The CO₂-concerned public must quit pinning its carbon-reduction hopes on romantic illusions and urban myths about trees, because dense forests (especially rain forests) have relatively low carbon levels in their soils. Trees annually produce much smaller root mass than grasses on a per-acre basis.

There is much greater potential in grazable woodland habitats than in dense forest. Aspens, for example, can grow mingled with up to a ton per acre of grass and forbs, while dense conifers can not. Piñon/juniper woodland need not be eradicated to grow grasses. Thinning them on a sustained-yield basis would triple wildlife and livestock carrying capacities in these often unproductive woodlands and grow lots of grass while greatly improving the watershed. Such thinning would also allow the West to become completely self-supporting in home heating fuels. Piñon/juniper and horribly fire-prone and too-thick mountain conifer forests should be seen as gigantic biofuel resources. Pelletizing



ABOVE: This pulse-grazed steppe site has been experimentally thinned of sage—resulting in exploding grass populations. Such dryland sites can still play a large CO₂-removal role because of their vast acreages. Proper biological planning will maintain enough sage for winter-foraging deer, pronghorns, sage grouse and other sagebrush obligates. As site health and soil improves, grass productivity creates a spreading web of causation—leading to more water, wildlife and prosperity—and all the time chugging down CO₂. BELOW: Pulse grazing is more powerful than CO₂ buildup. Aspens, grasses and arbuscular mycorrhizal fungi are wonderfully and abundantly co-symbiotic. Up to a ton of grass and forbs per acre can grow among aspens—as the photo shows. Grasses produce up to three times the weight of surface growth underground as roots and root hairs. This chest-high grass is pulse grazed—and visually represents hundreds of millions of hectares worldwide with similar potentials (here, 23 inches of rainfall) to stuff carbon into the soil. If practiced worldwide, pulse grazing could sequester the entire buildup of CO₂ since the dawn of the industrial age.



Ground near junipers and in piñon/juniper woodland is frequently barren of grass. Here, biologically planned pulse grazing has converted this 11- to 13-inch-rainfall juniper site to abundant grassland—pulsing carbon into the soil. Thinning P/J and other forests can increase grass biomass thousands of percent, reduce fire danger and multiply economic, watershed and wildlife value many times.

these extra trees—foliage and all—could create a flex-fuel strategy for homes already plumbed for natural gas. This could leave vast amounts of natural gas available to power vehicles and reduce dependence on foreign oil. Trees also easily substitute for coal in power plants—removing fossil CO₂.

Much, if not all, of this information is common knowledge in ranching circles. As usual, we cowboy-logic types are left to wonder where the “experts” get their illogical ideas. World media quoted Al Gore at a U.N. Climate Conference, “I think soil carbon conservation and re-carbonization of soil must be the next stage in this negotiating process.” Gosh, Al—ya think? We regular folks would all prefer to start with the processes that actually work, don’t blow energy prices through the roof, don’t require massive taxes, economic and social upheaval and loss of political freedoms!

See, Al, some 30 years ago, Allan Savory, this wild man from Zimbabwe, started ranchers, federal-agency folks and academics thinking about the power of grasses to heal soils and social, economic and environmental ills. We’re all tooled up and eager to serve. There are lots of us—around the world. Please join us in good faith. You’ll never have a better time or make better friends than the ones you get healing the land together. A lot of agency folks, ranchers and enlightened, informed environmentalists are ready to pledge their lives, fortunes and sacred honor to get this work done. Urban mythology now prevents much of what must occur.

Society has been taught that a useless and fuzzy hands-off, “naturalness” policy will save nature. So it is ironic that a possibly fake crisis may have the political juice to fund actions this article recommends. We must do what is necessary to restore our soils. The health of nature in the West is often one-tenth of what it could be, and most of the lost health ties directly to our soils. The fact is, part of the sky—the CO₂ part—actually does need to fall, and the whole world would hugely benefit if we worked together to put it back into the ground where it belongs. ■

Steven H. Rich is president of Rangeland Restoration Academy in Salt Lake City. rangelandrestorationacademy.org.

Interested readers should check these websites and follow the links: www.soilcarbon.com, www.ars.usda.gov/IS/AR/archive/sep02/soil0902.htm, www.managingwholes.com, www.amazingcarbon.com, www.carbonfarmersofamerica.com.