

Integrating Livestock into Agroforestry

My family and I are owner operators of Hacienda las Imagenes in northwestern Costa Rica in the province of Guanacaste.

We are practicing regenerative agriculture for more than 20 years on a 1600 hectare ranch. Half of our area is in forest. The other half is in mix use, pastures and forest with primarily native grasses.

There is great potential for carbon drawdown in the tropics that is not being utilized.

Central America has the greatest degree of soil degradation in the World. We should have a significant contribution to building soil fertility not losing it.

It is always a good idea to take a look around.

Nature with millions of years of trial and error has pretty much figured it out.

If you are in a deteriorated environment, determine what was historically going on.

Work towards restoration of diversity particular to your area.

Joining into a naturally functioning system increases the chances of being successful.

We humans have this tendency to try to one up Nature.

So far this hasn't worked out very well.

At Las Imagenes we are in the remnants of a tropical dry land forest.

Any land use plans for our region had better include trees.

Guanacaste is well into the desertification process.

Maintaining ground cover, absorbing and retaining moisture, and increasing the greatest amount of forest coverage possible is just common sense. You would think.

Common practice is burning in the dry season and spraying in the wet season.

If you are intentionally trying to create desert this how to do it.

Where we could allow for reforestation we did.

In our case this was where there is significant grade to impede forage maintenance.

Forests and waterways were fenced off and remote water sources established.

For 7 years we had 600 hectares in an environmental services program, FONAFIFO.

Even though substantial areas have been returned to forest production has increased. External inputs have been reduced. Increasing forest coverage is improving the “sponge” effect in our soils. Transpiration is critical in dry times.

Shade and wind breaks along with fertile soil help to hold moisture.

In our region the objective should be meadows surrounded by trees.

Well into the dry season grasses have reduced benefit.

Seeds and forest forage become important.

Almost weekly there are new feed supplements supplied naturally.

I am referring to cattle in pastures with trees, not in forest.

There should be no friction between ranchers and forest advocates.

No forests should be cleared for any reason anywhere.

This includes ranching, farming, and residential, including land reform.

All hillsides with significant grade should be in a reforestation process now. All burning should stop immediately.

Silvopastoral systems help to solve problems both groups have in common.

More forest coverage and corridors between forested areas is an inevitable result.

Allowing for marginal pastures in unmanageable areas to return to forest reduces costs and increases value of properties.

Positioning for carbon credits and forest programs such as FONAFIFO is a plus for any agricultural enterprise.

As more examples come forth presenting beneficial results from regenerative agricultural practices, more farmers and ranchers will begin to experiment.

A system of carbon credits and taxes is essential to help people get started.

Farmers and ranchers need to become true carbon farmers.

The extra effort and expense to do things the right way needs financial incentive.

So how do cows fit in?

You have probably seen diagrams of differing levels of development in grasses and forage in a pasture.

After a dormant period, which is a dry season in our region, rains come and plants and roots begin to grow.

There is an optimum developmental stage for forage.

This is the most efficient time for photosynthesis and for carbon dioxide and water to be converted into carbohydrate sugars.

At this time carbon sequestration into the soil is at it's highest potential.

At this time forage is at it's optimum height.
Sufficient surface and root mass are present.
There is active nutrient acquisition.
This is the beneficial time for quality tender forage.
This is the stage of growth cows are searching for.
This is also the stage where we can manage to drawdown the
greatest amount of carbon dioxide from the atmosphere,
convert to "liquid carbon" and process this into the ground
through a "microbial bridge".
This is how we build soil fertility.
Cows are an integral part of this process.

If this point in the growth cycle continues unchecked, mature
and less desirable forage is not utilized and left to oxidize;
carbon dioxide is returned to the atmosphere.
As Walter Jehn puts it, "Nature had to invent a 4 legged
mobile bio digester to process all of this surface material and
build soil to maintain an atmosphere conducive to life."
It used to be huge herds of wild herbivores. Now it's cows.
We need to maintain this optimum forage level for the longest
amount of time with each growing season.
In the tropics the potential for carbon storage is significant.
Sequestration can be continual and enhanced by maintaining
this optimum forage height repeated many times.
Animals often choose to eat one type of forage more than
another. They will selectively graze the young tender grasses
leaving the older mature plants. It is important to level the field
in order to have the next grazing period consume the forage
evenly.

This can be achieved by managed intensive grazing and followed if necessary by cutting or mowing leftover less desirable forage.

As surface area reduces root mass will reduce or slough off correspondingly.

As leaves begin to regrow and photosynthesis kicks in, "liquid carbon" coupled with nitrogen is exuded through the roots into the soil.

New roots begin to search out new routes.

These root extensions increase aeration and water absorption.

So what types of forage are best?

Those that can be managed most efficiently to maintain this optimum height.

They need to have the ability to partner up with other forages. Any monoculture is going backwards.

When we started out our open areas were mostly undesirable weeds due to years of burning, chemicals, and overgrazing.

As we began to mow we persuaded what we wanted, which typically grows shorter, mostly perennial and dissuaded what we didn't want, which typically grows taller, mostly annuals.

Over time a ground cover of native grasses, legumes, and assorted forages has been established.

Greater diversity in forage increases resiliency.

Biological tillage is enhanced by different plants with different root penetrations.

Diverse exudates allow for a greater variety of microbes.

The difference between a monoculture and a variety of forages is significant.

.(Check out the 15 year Jena Experiment in Germany.)

Carbon storage, biological fertilization, microbial activity, nutrient acquisition, animal fertility, and productivity increase.

Our primary grass is grama, *Paspalum Notatum*. Also known as jengibrillo, bahía, batatais, grama dulce.

It came up on it's own.

Probably waiting in a dormant stage for the opportunity to establish a community.

It is generally considered that these native grasses are less productive.

This is true if not managed properly and left to mature.

Crude protein is greater than 20% in two weeks and then declining.

Total digestible nutrition is greater than 70% in this time period and then declining. (Actually, this is the case for all forage.)

This is why managed intensive rotational grazing is so important.

Here is a list of pros and cons for these native grama grasses

- Permanent forage for intensively grazed pastures.
- Drought resistant ground cover with a deep root system.
- Suitable for agroforestry.
- Persists well under sustained grazing in shaded situations.
- Maintains dense stands due to nitrogen fixation in the rhizosphere due to root associations with arbuscular mycorrhizal fungi and diazotrophic nitrogen fixing bacteria.
- Grows in a wide variety of PH.
- Survives flooding for over 30 days.
- Low growing grass that can tolerate frequent defoliation.
- Highly competitive species where it is regularly defoliated.

The real test for any long term agricultural endeavor is the amount of organic carbon being added and whether soil fertility is on the way up or down.

This is best achieved on farmed land with multi species perennial cover crops or on holistic intensively managed grazing on pasture land with multi species forages.

Regenerative agriculture is always building soil fertility rather than losing it.

In summary:

Forests are easy. Give your native species a hand and help them to reestablish wherever possible.

It is essential to support diversity.

Grazing land requires more input.

We have to manage against early maturity and seeding of forages.

Every time we restart the optimum growing period we are mainlining liquid carbon and nitrogen into the ground; increasing soil fertility, production, and drawdown of atmospheric carbon dioxide.

There is so much information available to help you regenerate soils in your particular area.

Christine Jones at amazingcarbon.com and

Walter Jehn at healthysoilsaustralia.org are two good places to look for further information.

