The Great Simplification - Frankly #8

Nate Hagens (00:05):

Hello. Good morning. Time for another frankly. This week's commentary is on the global situation with forests and using firewood for home heating in the winter. I originally was going to call this post the Lorax. I also considered calling it the TDE, the terminal deforestation event, which is a little gloomy but possible. I decided to call it the sixth pool as in the sixth pool of terrestrial carbon that humans access to add to our economies. So this week the European commission just voted to remove subsidies on using pellets, sawdust, et cetera, for home heating because a growing recognition that there are limits to forest biomass in Europe. As many of you are aware since early this summer, firewood is virtually sold out across Northern Europe. You cannot buy firewood at any price in Germany. And this is because people are anticipating even a normal winter, that there won't be the natural gas available to provide home heating.

Nate Hagens (01:26):

So in this brief overview, I'm going to talk about the relationship between humans and forests, the relationship, at least in the United States, between the amount of fossil fuel we use and the forest biomass, and the fact that there are virtually no models in climate space or in governmental forecast, looking at humans, returning to biomass in a large way. So let's start with the history of forest. Humans and even our pre homo sapiens ancestors have been accessing forests or wood for hundreds of thousands of years. The standing forest we have today is around a third smaller than it was when we started the agricultural revolution. So there are five pools of terrestrial carbon. The first pool is soil, which is at the agricultural revolutions, humans started to unmask access the chemical bonds in the soil, not directly for carbon reasons, but for nutrients, phosphorous, potassium, et cetera. And this thus released the carbon embedded in the soil.

Nate Hagens (02:40):

The second pool was forest. We used forest for timber and fuel and heat and construction materials and we're running out of forest when we puzzled out how to access buried ancient sunlight under the ground in the 18th and 19th centuries. So the next pool was coal, and the next pool was oil, and the next pool was natural gas. Those are the five pools of carbon. Note that there's an increase in energy density as we go from wood to coal to oil, which means how much energy is in one unit volume or weight of the mass of the fuel. So coal is significantly more energy dense than wood and oil is significantly more energy dense than coal. So we don't think about it much, but in the early years of our country, the mid 19th century, much of the Eastern coast was denuded. Vermont was 90% deforested because of the access to using trees for all these things.

Nate Hagens (03:56):

So if we look at the last two centuries of humans and energy use, this is where the superorganism or the Lorax comes into play is we started to go to coal than oil than gas than nuclear, hydro, and renewables. But now 150 years later, we are using more wood in total than we were 150 years ago because of the size and the scale of the global access to timber and veneer and pulpwood and furniture and all that has dwarfed what we used to use. Okay. So how does the amount of forest in BTU terms compare to

the amount of energy we currently use from hydrocarbons to heat our homes in winter? The following several graphs were something I made 15 years ago, comparing the United States home heating situation. The same data applies today. It's just there's more people and more energy used, but the graphs roughly remain the same.

Nate Hagens (05:01):

So if we think about the standing forest stock in the world or in the United States, it grows at around 2.5 to 2.8% a year. And actually this is declining for various environmental reasons. 50 years ago, it was 3% a year. So you think about the forest capital or principle, and then the interest, which is the growth per year, that would be the amount that we could harvest in a sustainable fashion. So 2.7% of the forest, standing forest, that amount could be sustainably harvest. So we use very little wood in the United States directly for heat. We use forests for a lot of things, but only around 10% of it is used for wood. I mean, for heat. The majority of heat in the United States is natural gas and followed closely by heating oil or distillate, which comes from a barrel of oil.

Nate Hagens (06:06):

Using wood is really a small fraction of our total energy use. So these next few graphs show a GIS overlay of the United States. This is how much heat per person we use in the winter in the various states in the United States. You can see the darker, the color is the colder the environment. This shows the same graph, denominated by population. So California isn't that cold, but there's almost 40 million people there. Same thing with New York, we use a lot of fossil natural gas and distillate for those places. Then if you take the tree census in each of these states and you divide it into cords of wood, this is the number of cords of wood that exist per person in these states. Now, of course, my analysis looked at stoves and heating at home, which you can only really use hardwoods because soft woods have creosote and they have fire damage.

Nate Hagens (07:15):

So hardwoods, deciduous, Oak, maple, things like that are around 40% of our forest stock. So if you relax the assumptions I'm about to say it would be two to two and a half times longer is the result. So the other point that I would make is a lot of our forest are inaccessible. If you consider living in a house like this, the trees right close to your house are definitely accessible. Maybe you go up the hill, you can access others, but some of them on a steep forested slope either don't have the complexity and bridges and infrastructure to get to, or the energy required to get to them is too much to actually have it useful. So the upshot and the bottom line, and kind of the smack in the face conclusion that I had is that we have very little forest biomass relative to the amount of fossil energy that we use.

Nate Hagens (08:17):

This is broken out by state. And of course the green in the lower Southeast is a combination of, they don't get that cold in winter and they have a lot of forest, but many of our states would be denuded in a year or two if we had to access our trees to heat our homes in winter. So the relationship between our standing forest and the amount of fossil energy we use each winter is massive. I don't think we talk

about this much. We take it for granted that our fossil stocks to generate heat in the winter will always be with us. So the open question then is what happens on the downs slope of the carbon pulse to the world standing forest? History would suggest Easter island, many other historical cultures denuded their land because they were compelled to use the remaining forests for timber, fuel, et cetera.

Nate Hagens (09:22):

We look at a modern example, an aerial view of Haiti versus the Dominican Republic. Haiti for various economic, social reasons has completely denuded their landscape. Dominican Republic either because it's a wealthier country or because prior generation, they had a dictator that would not allow people to access the forest has standing healthy forests. So one of my concerns here is that we don't recognize the importance of forests as both sources of ecosystem services. They act as biological pumps that create weather, that offer sanctuary for insects, birds, animals, and ecosystem services, but also a sink. They are the biggest sink other than the oceans in the world. Right now, the world's forests sequester around 60% of our fossil carbon from emissions. Okay. Now, if you subtract from that, the deforestation that comes from the Amazon and other places, it works out to be about 15%, but still it's a massive sink that we take for granted.

Nate Hagens (10:45):

In fact, there is no integrated assessment climate model in the world that specifically targets a decline in economic growth this century. And more importantly, what humans will do to the standing forest in that moment and what that would do to our climate scenarios, not so much how much carbon we emit, but how much the Earth's natural systems can absorb. If we turn back to a lower density source of energy, the way that we used not so long ago, it was the year 1910 before wood was no longer the number one fuel source for humans on the planet. So it's only been 100 years that coal, oil, and natural gas have supplanted wood. If we go back there, what does that mean for the carbon sink capacity of the world?

Nate Hagens (11:43):

Already, the Amazon forest because of deforestation is no longer a net sink. It is a net source of carbon emissions. I think now, and in the future, there will be many examples of humans rising to the occasion and being altruistic and helpful to other humans. But this is human versus human. It is not human versus ecosystem. And unless we plan ahead of time, unless we think and process the importance of Earth's forest, they may be a casualty on the down slope of the carbon pulse. So this is kind of a brief rant on the importance of trees and the importance of forests. What do we do about it? Go spend time in nature, go spend time in forests and learn about them. Hug a tree, plant a tree, love a tree and protect a tree. Thank you. I will see you next week.