**"Diversity Replaces Nitrogen"**

**Christine Jones** has a fantastic ability to compress a core message into a short phase without diminishing the complexity of that message. Dr Jones opened Biofarm again this year, and like last year she laid the path and context for the whole event. The other speakers consistently referenced her message over the five days.

Dr Jones opened her talk with a proven but contentious statement that short-rotation timber (i.e. Sitka spruce) is not a solution to climate change or a tool for storing carbon. She stated, "The carbon in harvested timber is rereleased faster than the time it takes that timber to grow. There is zero net carbon sequestration benefit from harvested timber".

She went on the explain that soil is the worlds largest carbon sink, and the world's topsoil holds three times the amount of carbon as the vegetation growing on it. What was new information to many was that subsoils contribute to more than half of the worlds soil carbon stocks. The carbon stored below 30cm, she said, is the sequestration of significance as it is far more stable than topsoil-carbon. Carbon stored at these depths is instrumental in flood mitigation, hydrological function and farm productivity.

Once she set the stage, she continued to outline the dynamics of how this deep carbon is created, or not created in many cases. "If your plants are producing root exudates, there will be a rhizosheath on the roots. Within rhizosheaths there will be lots of fungal hypha and trillions of bacteria, feeding the plants and building carbon. Plants do not have access to this rhizosphere microbiome when grown under conditions that disable it such a when using high analyses synthetic Nitrogen or Phosphorous, or when plants are grown monocultures".

Her two talks were peppered with frontpage headline-worthy warnings like  - "Monoculture ryegrass with high levels of synthetic fertiliser will never sequester carbon. We have an agriculture-based predominantly on grass, it is very simplified, and it doesn’t function".

The solution to this disfunction is simply appropriate management that enhances biodiversity and increases the complexity of plant and therefore, soil microbiological communities. Again she referenced the Jena biodiversity experiment, in Germany, where they showed that eight species from four functional groups – grasses, legumes, short and tall non-leguminous herbs, proved that diversity replaces the need for synthetic Nitrogen in conventional agriculture.
She elaborates with another killer line - Nitrogen is required in low diversity plant communities because it is a "**surrogate for soil function"**. Once plant diversity is above eight species from four plant groups, the soil function will improve, and pastures will be more productive without Nitrogen.

The regenerative agriculture movement promotes no-till arable systems, which is a challenging goal for an organic operator who is without the tool of herbicides. Never one to follow the dogma of popular opinion, Dr Jones delivered another curveball which was reassuring to us, organic farmers. She explained how the ecologic hypotheses of "intermediate disturbance" is a bell curve with a sweet spot at around 20% disturbance. In a [case-study](https://youtu.be/5rn6Q6R1tAw), Niels Olson, the first farmer to get paid for scientifically varified sequestration of soil carbon, in Australia, developed the Soil Kee Renovator - a surface rotovator and seed drill combo, which will terminate crops and sow new seed with a single-pass, min-till operation. This machine incorporates 20% of the plant litter into the surface of the soil, 80% left on top while sowing the new crop in a single pass. Dr Jones claims it is not true that we need zero soil disturbance, about 20% surface till seems to be about ideal. She references a wild natural ecosystem, "there is a niche for animal species that create a minimal soil disturbance like pigs, for example. 100% disturbance is not good but leaving it totally undisturbed is not good either."

To conclude the first of her talks: high diversity swards, will produce more biomass, sequester more carbon, build deeper soil, improve water cycling, and higher farm productivity, better animal health, and is beneficial for insects because many of the pasture plants will have flowers, and beneficial for birds that will feed on the insects. The diversity of birds is often a very good indicator of how well the whole farm is functioning.

Her second talk, titled "The Understory" was illustrated with beautiful microscope photography, she described the elegant interaction between the soil biology, the plant roots and the root exudates.  Exudates are sugars that the plant expels from its roots to attract nutrient-dense microbes into its root zone or the rhizosphere.
Dr Jones coined the term "liquid carbon" to describe these exudates and introduced us to a new term - "the soil sociobiome" to describe the interactions and exchanges that happen in the rhizosphere.

Only plants and microbes working together can produce fertile, well-structured soil. This is called a "Holobiont" - defined as a host and microbiome which together make a whole. All living things are holobionts because all living things have associated microbes which are integral to their health and function.

She introduced this terminology not to confuse but to emphasise further that the soil without a functioning and diverse plant community will not have its associated microbes and therefore will not be Holobiont and will not function.

After an in-depth whirlwind summary of the latest soil science, the same final message is always reinforced - "It is diversity that creates and preserves soil function."

To watch recordings of Biofarm 2020 you must be a ticket holder, however, Christine Jones' presentation from 2019 was equally insightful and available to [watch here](https://youtu.be/i8y7AUb1oRY).