**Summary: Investigating Soil Chemistry on Intensive Horticulture Sites and in Associated Dam Sediments**

Southern Cross University Researchers conducted preliminary tests on the soil quality of three blueberry farms in the Coffs Harbour local government area through funding from the Coffs Harbour City Council's Environmental Levy program. Two of the farms studied were from the coastal area near Sandy Beach, while the second farm studied was inland behind the mountains near Bucca Bucca Creek.

For this study, soil and sediment core samples were taken along the study sites. As scientists, and for the purpose of this report, we classify dry, terrestrial earth as 'soils'. Several sampling sites were selected based on our predictions of where we might find commonly used farm chemicals. In NSW, farm chemicals are required to be locked away in a shed. This means farmers usually have a nearby area where they mix and prepare the chemicals to be applied to crop production areas. Using this knowledge, we took soil cores from nearby the chemical mixing sheds, where the farm chemicals are prepared before being applied to the crops. We also took terrestrial soil cores from the blueberry field, where the chemicals are often applied.

While farm chemicals are typically applied to the blueberries on land, these chemicals can be mobilised in water with rainfall or irrigation. Dams act as collection basins for water, meaning they might 'catch' some farm chemicals as they runoff during wet events. So, to investigate what chemicals may move from the farm to nearby waterways, we took sediment cores from dams at each farm.

What do we scientists mean by 'farm chemicals'? After collecting cores, we performed specific chemical analyses looking for fertiliser nutrients, such as phosphorus (P) and trace metals on all sediment core intervals. Trace metals can come from treatment products like fungicides or insecticides, but also exist as impurities in fertiliser products. In addition to trace metals, we analysed many different classes of pesticides, including organochlorines, organophosphates, fungicides, herbicides, and other insecticides in the terrestrial soil cores.

Once our analyses was completed, we compared the levels of trace metals and P to well-established environmental standards from Australia and other countries overseas. These standards, or 'soil quality guidelines' (SQG for short) allow us researchers to know which specific elements may be troublesome for critters living in the dirt or nearby waterways. These results indicated that a site in Sandy Beach, which had been a banana farm for many years, had high levels of arsenic (chemical symbol: As). These high levels of As are likely a result of many years of using pesticides which contain As for banana cultivation. Without more research on how our observed levels of As are affecting soil critters, we are unsure of the broader ecological effects. Good news is none of the other sites had any high levels of As, indicating it may only be a localised issue.

Each of the 3 sites had core subsamples which exceeded the SQG for the fertiliser nutrient phosphorus (P). Phosphorus really likes to bind to soil particles, meaning it's build up in the soils is quite natural. Repeated fertiliser applications, especially over many years of farming, like in the Sandy Beach sites, will lead to high levels of P in the soils.

At the bottom of the dam core at a Sandy Beach farm, we found high levels of mercury (Hg). Mercury can be very toxic to fish and other organisms, and can biomagnify up levels of the food chain. However, looking at our sediment core profile (the vertical distribution of Hg along sediment depth), we see that most of the Hg is buried towards the bottom of the sediment core profile. Typically Hg that is deposited in deep sediments stays there, unless it is dug up or disturbed.

We surveyed for 97 different types of pesticides. We found a total of 9. The Bucca Bucca site had the most pesticides in the chemical mixing shed and growing area. We found several fungicides on this farm. We know from talking to the farmers that these inland areas, which don't receive a sea breeze, have different fungus problems than coastal farms. This could be the reason we've detected more fungicides in the soils here. Another fungicide was found at all three farms, implying its use is widespread in the area.

While we found a few pesticide residues that were used in the banana farming era, we found none of the very toxic organochlorines. Even though we found a few pesticides (9 out of 97 we looked for), we as researchers still aren't exactly sure what will happen to these pesticides. Some pesticides can be broken down quickly with light exposure and by soil bacteria. Other pesticides can tightly bind to soil organic material particles and remain may remain in the soil for a long time, albeit in a form which is unavailable to soil critters. Some pesticides can remain dissolved in water, like sugar in tea, and may runoff in groundwater after rain events. Because we only took samples during only one sample campaign, we only have a 'snapshot' of which chemicals were there at the moment of sampling.

This study was a baseline study, to investigate some potential contaminants which may be coming from a new farming industry in the region. Without further research, we have no idea how these chemicals move throughout the farm and even to the nearby environment. Conclusions from this study are basically that we need to do much more work to determine fates and broader ecological effects of chemicals from farming in the Coffs Harbour region.