DECOMPOSITION AND MEMORY

First impressions – the head is enthralled, the heart is repulsed

There is something interesting and exciting going on here. Ecologists – members of my tribe – were here! I revel in the familiar: tall and wide plastic collars are set to measure log respiration – the loss of CO_2 from these decaying logs – and plastic funnels move water running off the moss-covered log into plastic carboys that collect the throughfall for future analysis. How do decaying logs contribute to the carbon balance of the forest?

What are these tubular excrescences? Are they part of the log? Melting into the log? No, just silicon skirts connecting them to the log. Why is one erect, and the other recumbent? Logs decay after centuries, a plastic cup takes at least 250 years to decay; how long will the pipe tube cylinders last? Across the path, a plastic funnel and a plastic bucket (no, not a bucket, a carboy) broken; shards on the forest floor becoming the nanoparticles of the future soil. Will they end up in some earthworm, some mushroom, some newt? This installation violates the integrity of the forest.

There is wrongness here.

Second thoughts – what has been learned?

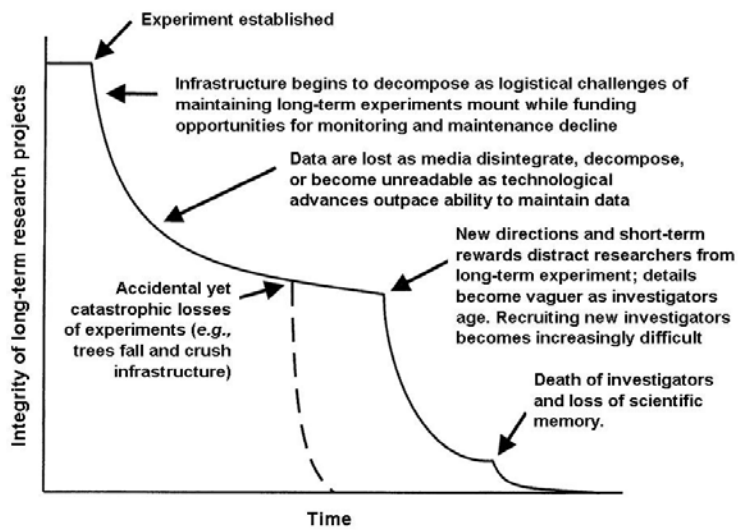
I know this experiment. It is a canonical example of a truly long-term study. Established in 1985, intended to run for 200 years, it will reveal elements of the process of decomposition of heretofore unappreciated by ecologists and foresters.[i] The experiment was designed thoughtfully, with careful attention to replication, sampling interval, and analysis. I explore the archive of the H.J. Andrews Long Term Ecological Research site – there are scant publications on this experiment,[ii] and then only from the first few years after it was established. Data are posted on-line in some cases through 2001, in others only through 1988. Available data on log respiration measurements run through 1995, and have never been published. Are data still being collected from the respiration tubes; looked at and analyzed; prepared for publication? How fast are these logs decaying?

These logs are impermanent. The forest is impermanent. This world is impermanent. Are any parts of the log permanent – the molecules, the atoms? The carbon in these logs was in the atmosphere, was fixed by the trees when they were still alive and used to build cell walls, trunks, branches, leaves. This carbon is now being returned to the soil, to the water, and back to the air. It is respired by the log, it is ingested by the mushroom and the flies, and it is re-inspired by the trees around us.

It is enough to know this; I do not need to know how much or how fast.

The next day – what we remember, what we forget

What is remembered in a day, much less after 200 years? The log decays, and as this figure shows, we envision a simultaneous decay of the integrity of the experiment.[iii] The log decomposition experiment is not just the data. Recalling specific details, juggling idiosyncrasies of methods (in fact, the methods for measuring respiration changed in 1992), and ensuring validity of future measurements all are contingent on maintaining the experimental apparatus. The collars are only weakly attached. Silicon plugs (for temperature probes?) are exposed, extruded, or fallen. Is this experiment maintained or unmaintained? Does it matter when the sampling interval is 8 years, 16 years, 2^k years? Maintenance becomes more critical as sampling interval lengthens, but it also becomes easier to put off maintenance for another season. It is similarly difficult to maintain the integrity of the data themselves – numbers on paper, magnetic bits,[iv] optical codes, droplets in the cloud of the world-wide-web – the half-life of storage media is falling as quickly as new media are invented.



And the interpretation and publication of the data are integral data, too. If the data are not published and interpreted, will future generations of scientists know they exist? Will 22nd-Century graduate students be inspired to continue maintaining this experiment, measuring tissue mass-loss, log respiration, throughfall chemistry? The broader issue: how do we maintain continuity of research and researchers? How do we maintain enthusiasm for ecology, for this science? Do ideas and intellectual fashions decompose too, only to be reborn in a new experiment, a new subdiscipline, a new journal?

Science is narrative, and these decomposing logs tell a story. But even though only 25 years have passed, the story is already fragmenting. Like the monks poring over the relic of Saint Leibowitz,[v] what do we now think of its original state – 8.9% outer bark, 4.0% inner bark, 28.5% sapwood, and 58.7% heartwood – and what will we think 200 years from now? I can see no outer bark and I don't know if it even mattered. I don't even know how to read the story of the bark. The logs remind me of the stone walls of my New England home. The forests were cleared, the walls were built and they bounded and defined the lives of the early European colonists. The colonists moved on, their stories are in fragments, and like these fallen logs, the stone walls meander through the now-regrown forest. Boulders erode, logs decay. We know the “big picture” – cellar holes, pasture walls, boundary walls – but the details are lost – whose house, what was he thinking the morning he laid the first stone or placed the last.

More fragments.

The cost – what is this knowledge worth?

The scientist in me learns the details: 530 logs, 5.5 meters per log, each 0.5 meters in diameter, removed from intact stands and clearcuts along the 1506-630, 1506-320, 1506-350, and the 1506-354 roads. I calculate: 182.1875 cubic meters of wood, or about 50 cords. Enough to heat the average-sized, modestly-insulated New England home for 10 winters.

Access roads into old-growth forests were built simply to haul in and emplace (damage was minimized); after the logs were entombed, the roads were closed, pyramids re-sealed.

Logs were measured, experiments were established, data were collected.

So many trees, so much wood. Clear cuts rending the forest in the service of science.

The passive voice astonishes. Who was responsible? Who built the roads? Who gave priority to saving old-growth trees over saving small trees? How did he feel when the big trees came down, were bucked into pieces, were yarded into place? All to learn that logs decay.

I drive the 1506 road through the old growth, past the regrowing clear cuts. Without a map, without a guide, it would be impossible to know where the logs came from, where is their final resting place.

The logs decay, the trees inspire, the forest returns.

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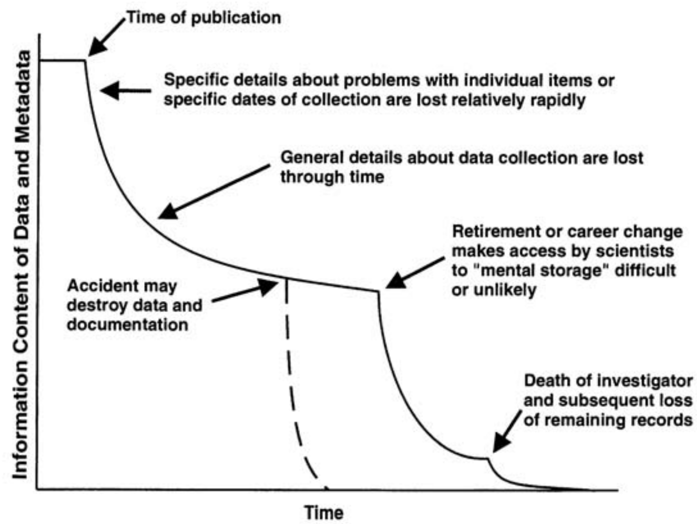
24 October 2010

Notes

i The design of the experiment is described in detail in M. E. Harmon (1992) Long-term experiments on log decomposition at the H.J. Andrews Experimental Forest, *U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station, General Technical Report* **PNW-280**.

ii In addition to the 1992 report describing the establishment of this study (see note i), others include: S. E. Carpenter, M. E. Harmon, E. R. Ingham, R. G. Kelsey, J. D. Lattin, and T. D. Schowalter (1988) Early patterns of heterotroph activity in conifer logs, *Proceedings of the Royal Society of Edinburgh* **94B**: 33-43; R. G. Kelsey and M. E. Harmon (1989) Distribution and variation of extractable logs of four conifers after one year in the ground, *Canadian Journal of Forest Research* **19**: 1030-1036; R. P. Griffiths, M. E. Harmon, B. A. Caldwell, and S. E. Carpenter (1993) Acetylene reduction in conifer logs during early stages of decomposition, *Plant and Soil* **148**: 53-61; M. E. Harmon, J. Sexton, B. A. Caldwell, and S. E. Carpenter (1994) Fungal sporocarp mediated losses of Ca, Fe, K, Mg, Mn, N, P, and Zn from conifer logs in the early stages of decomposition, *Canadian Journal of Forest Research* **24**: 1883-1893; M. E. Harmon and J. Sexton (1995) Water balance of conifer logs in early stages of decomposition, *Plant and Soil* **172**: 141-152; and J. D. H. Spears, S. M. Holub, M. E. Harmon, and K. Lajtha (2003) The influence of decomposing logs on soil biology and nutrient cycling in an old-growth mixed coniferous forest in Oregon, U.S.A., *Canadian Journal of Forest Research* **33**: 2193-2201.

iii The figure is modified from the one at the right illustrating the decay of data. I retained the shape but changed the text. The original was published in Michener, W. K., J. W. Brunt, J. J. Helly, T. B. Kirchner, and S. G. Stafford. 1997. Nongeospatial metadata for the ecological sciences. *Ecological Applications* **7**: 330-342.



iv In 1992, Harmon (*op. cit.*) wrote that *the data collected on initial conditions and from subsequent samples have been stored on magnetic disk...* What researcher in 2010 has ever even seen a magnetic disk; if they remember what one is, does s/he regret their passing?

v Walter M. Miller Jr.'s post-nuclear-apocalyptic novel *A Canticle for Leibowitz* (1959, J.B. Lippincott & Co.), opens with the 26th-Century monks of the Albertian Order of Saint Leibowitz finding a relic of the blessed saint – a 20th-Century shopping list that reads "[*p*]*ound pastrami, can kraut, six bagels--bring home for Emma*." Given the near-total loss of knowledge after the nuclear holocaust of the 20th century and the subsequent purging and near-extermination of scientists, intellectuals, and otherwise literate inhabitants of Earth, the meaning of the words of this sacred fragment is much debated.