Kiss the ground (and make a wish): soil science and hollywood

Ronald Amundson

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When I was a young professor at Berkeley, my colleagues and I would frequently run into Jean Jenny, the wife of Hans Jenny, at various events on campus. Jean, a formidable force of nature with a deep interest in the future of soil science (and in the 1980's, its state of languishing in the backwaters of popular science), would frequently walk directly up to me and say, literally pointing her finger at me, “you guys need to make soil sexy!!”. I would laugh, but I pondered the issue many times. As a young and then minor participant in the field, it seemed well beyond my ability, or even vision, that soil science would somehow be the stuff of popular appeal.

Yet, here we are today. In the past decade or so, we have had high-end soil documentaries narrated by Jamie Lee Curtis (*Dirt! The Movie*) and Woody Harrelson (*Kiss the Ground*), with cameo appearances by people like Gisele Bündchen and Tom Brady. How much sexier can we get!? Soil is on the cover of The

New York Times Magazine (Velasquez-Manoff 2018), and the op-ed pages of the Washington Post (Barker and Pollen 2015). At this point, it is maybe useful to examine what this new-found sexiness means, for soils and for Soil Science, and consider if, or how, we might better create our own science-based stories about soil and human society.

Narrative framing, or more simply - telling stories, is a fundamental human quality. “We tell ourselves stories in order to live” (Didion 1979). But our stories can also be wrong, and ultimately destructive. The new wave of Hollywood soil documentaries, and particularly “Kiss the Ground”, tell a story of hope, coupled with a “happy ending”. This is the approximate story line about soils that pervades the core of this Hollywood narrative:

“We” have, in the recent decades, abused soils through industrialized farming, creating or contributing to looming food and climate challenges. But wait! “We” can change this, and “we” can solve our food and climate challenges by getting back to some basics, regaining lost arts and knowledge from our agricultural past or from traditional practices. “There could be a way to eat food that heals the planet!” Soil is the answer! Pan to a shot of a smiling Woody Harrelson, then fade to black. THE END.

Responsible Editor: Stuart Grandy.

R. Amundson (✉)
Department of Environmental Science, Policy, and
Management, University of California, Mulford Hall,
Berkeley, CA 94720, USA
e-mail: earthy@berkeley.edu

What is wrong with this story, particularly for natural scientists who must labor in a world of fact and reality? I first want to be clear that I find the motivation, enthusiasm, and intentions of the film-makers and participants to be genuine and enlivening. It is the narrative they have developed that is of concern here. I begin with the conceptualization of the practice of farming itself, which in most soil films is deemed both the current problem, and a magical key to the solution.

The invention of agriculture roughly 10,000 years ago, and the accompanying biological revolution called domestication, comprises likely one of the largest perturbations to the global biosphere in Earth history. In a brief period of time, humans changed the boundary conditions for much of the Earth in order to harness the sun (Christian 2018), an energy bonanza that in turn allowed the development of writing, elites, armies, arts, and science. The practice *has never* been sustainable, if we use soil mass balance as our metric (Amundson et al. 2015). Erosion, loss of C and N, removal of rock-derived nutrients, characterize the long history of agricultural impacts on soils. In the past century or so we have managed to re-gain mass balance only by borrowing resources from the future: finite reserves of fossil fuel are used to make or process fertilizers (some which have limited geological reservoirs). Without this technical intervention, many of us would not be alive. Prior to the Haber-Bosch process which now supplies our agricultural N, society was trapped in a cycle of low yields limited by N and other nutrients since no agricultural system is a closed elemental loop, and it never has been.

Second, we can't return to the pre-industrial landscape of the eighteenth or nineteenth century. This is a twenty first century problem, with twenty first century boundary conditions and constraints. First, we should use recent social science to help us (scientists) begin to reframe the nature and scope of the problem. Creating a truly steady state and C-neutral global soil management system is a Wicked Policy problem (Levin et al. 2012), one that is enormously complex, has many inter-related participants and components, and will likely take generations to improve. Same for C in the atmosphere. A hazy view or wish for a return to a past agricultural utopia ignores that there never was one. Solving these problems requires more than magical thinking. It will require transformative ways of first framing the problem, and then approaching it

using a spectrum of skills from natural to social sciences. Creating a cradle to cradle soil and agricultural system will require urban planners, engineers, policy makers and politicians, and yes, soil scientists. This profound transformation can't be achieved simply by changing our eating habits.

Third, who are the “we” who need to “do this, or do that”? Most film makers, celebrities, and scientists do not own or operate working farms. Hundreds of millions of farmers around the world do that, and each is driven by multiple incentives, but mostly the need to support themselves and their families. In a manuscript I recently reviewed for another journal, which was an excellent review article about the potential to sequester soil C in agriculture, the word “we” appeared 35 times, largely used in the “we need to do this” manner. While the journal practiced a double-blind review system, I did not sense that any farmers were co-authors of the paper. This disconnect between an elite group of motivated citizens, and the people who manage the land that all these changes are intended to occur on, is an enormous blind spot—for both environmental advocates and many scientists—in terms of what can be realistically expected to change over decadal time frames.

Finally, there is the “happy ending”. From a film perspective, this is simply a long-standing Hollywood theatrical device. But there are much deeper psychological issues to consider in terms of balancing messaging with data and probability (Morris et al. 2020). This in many ways explains the appeal of Hollywood stories about soil, food, and climate. At the core is our brain, our powerful organ that evolved over millions of years of hunting and gathering. Its successful “fight or flight” response to stress and danger, which evolved on the steppe of Africa, is one poorly adapted to the array of complex, long-term cultural challenges we face today. Fear and danger still make us skittish, and a happy ending can be a soothing balm for issues that make our hunter-gatherer brains ache. Additionally, due to our genes and our community, we are all differentially endowed with values that further drive a fight or flight response to risk, a response that takes the form of rejection of fact and a dismissal of the problem entirely (Kahan 2012). The long-standing rejection by some people that humans cause climate change, or the recent rejection by many of the danger of a global pandemic, are driven by a cultural tribalism of those who share similar cognitive

functioning (e.g. see Mooney 2011; Kahan 2012). While social science is unveiling how we think and perceive information (Morris et al. 2020), it is also fair to say that it has only provided dim suggestions of steps toward improving human ability to accept the truth. The embrace of simple happy endings, on issues as complex as soil and climate, is in effect another type of denial of fact.

Is all this even important to scientists? It is. First, we scientists are part of our own unique communities of friends, organizations, etc. I was recently asked by a church group to lead a discussion of “Kiss the Ground”. All the participants were well educated, thoughtful, and engaged participants—especially after watching the film and its positive message. My effort to gently and respectfully add depth and nuance (and call out simple mistruths) maybe removed some initial sense of hope from those in the group, but it also led us to a genuine discussion and consideration of the complexity of the problems we face in society and in the environment. By comparing the complexity of climate change to long-standing social issues like the alleviation of poverty, we found a new way to reframe food and climate transformations. The longevity of social Wicked Problems is made startlingly clear by Biblical text itself: “For there never ceases to be poor in the land”, Deuteronomy; “The poor you will always have with you”, Matthew. These citizens are voters, and the voting public should understand we have no magic solutions to food security and climate change—and that soil is certainly not a double silver bullet as some films, and some scientists, propose. Scientists must be willing to help voters obtain reliable information in order to understand that these issues are not simple, nor are they insoluble.

Second, the wave of enthusiasm for soil C sequestration to store verifiable quantities of C in US agricultural land is now in mainstream politics, and was part of the political platform of several presidential candidates in 2020. This effort to encourage and monetize soil C is now working its way through Congress in several pieces of agricultural legislation. This will involve money—lots of money, an always scarce national resource. We, as soil scientists, must work with economists and others to determine the cost of these measures, their effectiveness—especially relative to other options. Most importantly, soil scientists should be willing to state whether alternative

C-reducing options are far more viable and cost effective than managing soil C.

In this unique era of societal interest in soil, the scientists who study soil should regain control of the narrative. We might steer the conversation through workshops or other teams that produce factual perspectives on the nature of key problems, and communicate this within and outside of our various professional societies. We must be deeply intellectually honest about these problems—soil is NOT always, *if ever*, a “win–win” solution. The parallel universe of warm and fuzzy views of soil is detrimental to our scientific profession and its reputation, adding a whiff of wackiness to our field as we work to integrate ourselves into the cutting edge of modern science, where our real future lies.

The individual stories of soil scientists are certainly going to differ, but if they are based on science, they will also all converge in a broadly common space. You may ask, what is the story I tell myself? Several years ago, in the first lecture of a large environmental issues class, I asked students to suggest environmental questions or topics they might like to learn about during the semester. The hands in the room had all disappeared, and I was about to continue the lecture. Then, a hand slowly rose from a young woman sitting near the end of the front row. I acknowledged her, and then quietly she asked: “Is it too late?”. This question shook me deeply that day, and it continues to do so. It is a question we must all seriously consider as the world changes, non-linearly, in a multitude of ways due to our influence (Steffen et al. 2015). Any eventual remedy for this will require innovations both small and large, and a keen spirit of persistence. It is unlikely that any one activity involving soil and land management will solve an entire problem, but when combined with other activities and efforts, it will at least be additive, if not multiplicative, in its effect. Thus, the story I tell myself is this: “I don’t think it’s too late, but I know there are no magical solutions”. It is between these endmembers of paralysis and bliss, both forms of denial, that the path to change and transformation lies.

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Declarations

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