Chapter 2

Earth Repair and Grassroots Bioremediation

Most of *Earth Repair* will focus on grassroots bioremediation, but it's important to remember that bioremediation is part of a much larger practice of earth repair, earth care and right relation. There are many other tools and practices that fall under the broad and deep scope of earth repair. In this book, we are just scratching the surface, focusing on a few tools for cleaning up contamination, tools that also renew and regenerate damaged landscapes.

Bioremediation works with living systems to detoxify contaminated environments. It includes microbial remediation (engaging the healing power of microorganisms like bacteria and fungi), phytoremediation (engaging the healing power of plants) and mycoremediation (engaging the healing power of mushrooms) to heal contaminated and damaged lands and waters.

To me, true grassroots bioremediation and earth repair aspire to the following:

- community accessibility and affordability
- working with nature to assist in its healing
- DIY (do it yourself) remediation, restoration and regeneration techniques that are high impact, low input, non-toxic, simple and easy to replicate
- prioritizing deep ecological healing and community justice as the motivating force

- embedding the skills and necessary infrastructure in our communities, especially communities most at risk for environmental disasters and contamination issues
- applying whole systems, multi-kingdom, multi-species, multi-tool approaches
- honoring local knowledge, local resources and engaging local decision-making
- empowering people to directly respond to their circumstances and crises in ways that increase their knowledge and self-determination and result in real improvements for the planet and their communities
- avoiding externalizing the problem whenever possible
- challenging and actively resisting the privatization and corporate ownership of solutions, spaces and living beings
- engaging in the powerful preventative medicine of resistance through grassroots organizing and mobilizing to stop destructive projects from going ahead
- acknowledging that it takes a community to make an earth repair project successful and seeking to build and maintain respectful relationships and trust with our many living earth repair allies (bacteria, plants, fungi, animals, people, ecosystems).

Grassroots bioremediation and earth repair mean choosing our interventions wisely, observing nature, learning and drawing inspiration from its brilliant design. They involve figuring out how to restore cycles and natural processes that have been interrupted, and working with nature's own healing mechanisms to organically and holistically restore wellness to a site. This work is not about being dogmatically attached to a specific tool or method. The true grassroots bioremediator is not someone who believes that mushrooms will save the world and wants to apply them to every situation. Instead such a healer is willing to consider that we have many tools at our disposal, that a lot of these tools work best in concert or in succession and that the environmental conditions of the sites we are working with may favor one tool over another. There is no one-size-fits-all approach.

This way of doing earth repair does not make much profit for

Conventional Remediation

Conventional remediation refers to the many ways that industry and government are approaching the removal of harmful chemicals and metals from contaminated sites, specifically looking at how they repair or "clean up" contaminated soil and water. Though I have some criticisms of how conventional remediation is done, it is important to recognize that there are situations where it can achieve strong results, some that may not be achievable by grassroots bioremediation, due to the extent and extreme nature of the destruction caused by the industrial system.

Both conventional and grassroots remediation have their blind spots. Some grassroots bioremediators can be blissfully overconfident about the healing power of nature without understanding the nature of contamination on a site. Some conventional remediation professionals can possess an overconfidence in using technology, chemistry and engineering-based solutions that do not work with the innate ecological intelligence of the land or the people who reside most closely to it; they can fail horribly at restoring the ecological integrity of a site. With the almighty dollar, public relations and government regulations as primary drivers in most cases, solutions and treatments are often selected based on their cheapness and expediency, leading to more of an excavate, cover and bury approach to cleanup.

That said, it is important to build relationships with key allies in this line of work. Many folks working in conventional remediation are in it to do good work and are equally unsatisfied with the outcomes and compromises they are forced to make by the corporations who call the shots. They have a lot of experience working with extensively damaged land and big projects, and this important knowledge and skills could be helpful to increasing the effectiveness of grassroots bioremediation efforts.

In Appendix 2, you will find descriptions of different conventional remediation technologies. I highly recommend you familiarize yourself with them. As a grassroots bioremediator or as anyone living in a community dealing with contamination, it is important to know what technologies and tools are currently being applied to cleaning up contaminated sites and what their impacts truly are.

industry. Its implementation pays off over time. Earth repair also doesn't cover up and hide the problem quickly enough to save public relations face or to get a speedy stamp of approval so that the problem is all wrapped up and companies can move on. Unlike most conventional remediation that treats the symptoms, patents the "cures" and profits from the lack of ecological health, earth repair methods seek the roots of the illness and act in ways that restore overall health and balance to these natural systems. These methods require frequent and lighter interventions over a longer period of time. These tools for repair and regeneration are not tools fashioned from the same industrial paradigm that created the problem in the first place. Unlike the chemicals and heavy machinery used in conventional remediation, you are working with living beings to restore life and health to other living beings. This is complex work that can be hard to control and hard to command with the quickness often required for disaster response.

These different microbes, plants and mushrooms grow differently in different soils, microclimates and in the presence of different contaminants. Therefore applications need to be tailored to specific site characteristics and conditions, making it challenging to have ready-to-go stock on hand. Some of these living beings are more sensitive than others, and you will have to coax and care for them in order to get them to the point where their healing powers are unleashed. In a way, you may have to become bacteria, plant and mushroom whisperers, and those of us who combine that care with a skillful and detail-oriented approach will be the most successful at this work.

Grassroots Bioremediation Reality Check

When I set out to write *Earth Repair,* I wanted to compile a how-to guide of empowering, accessible and holistic tools to help clean up the mess that's been made of this beautiful place we call home. The reality may be that we just aren't there yet. These tools are still being developed and honed; many of them are facing resistance and inertia from governments, industry and some professionals, which is further delaying their growth and ability to succeed. In order to be effective at this work, it is important to know what are some of the barriers you may face in doing grassroots bioremediation.

Barriers to Community-Based Bioremediation

by Scott Kellogg

The urban gardener is in regular physical contact with soil, breathing its dust and eating foods grown from it. Few others have such an intimate relationship with city soils, a resource that is seen by most others as something that only serves as a foundation for buildings and roads. Logically then, gardeners are concerned with soil contamination issues and are looking for simple and low-cost means to address them.

For a number of years now, urban gardeners and their supporting organizations have been aware of the concept of bioremediation. Bioremediation's use of naturally occurring organisms, apparent affordability and minimal disturbance to soils all add to its attractiveness. The idea of partnering with life-forms such as bacteria, plants, worms and fungi (all of whom gardeners are already familiar with) greatly adds to its appeal. Numerous scientific studies have been conducted that support bioremediation's effectiveness — there's no question that given the right circumstances, these organisms have the potential to degrade, immobilize or sequester a variety of contaminants. Bioremediation would appear to be an ideal and elegant solution to issues of soil toxicity. Why then, have bioremediation techniques not yet been put into use broadly as a means to remediate contaminated soils in urban gardens? Why are we not seeing citizen groups applying the tools of bioremediation and publishing their results?

These are questions that I have been asking for a number of years in my work designing ecologically and socially regenerative systems in urban environments. In 2004, the Rhizome Collective, an organization that I co-founded in Austin, Texas, received a $200,000 grant from the US Environmental Protection Agency to clean up a brownfield site located in the city. This cleanup primarily involved removal of tons of trash and debris — a twisted mountain of concrete, rebar, wood scraps, tires and carpet scraps — from a former illegal dumping site. Although levels of organic and heavy metal pollutants on the site met residential standards, concerns remained about the safety of gardening there, post-cleanup.

Unfortunately, funding in the grant would not cover the cost of soil remediation. Shortly afterwards, I was part of an effort to establish a community-based bioremediation plan in post-Katrina New Orleans to help address residual hydrocarbon contamination left behind from the storm. Compost teas were applied to areas known to be affected by pollutants. While the program received donations of services from soil testing labs, the funds were insufficient to carry out a properly managed remediation program on the scale that was necessary.

The barriers to community-based bioremediation are many. One such obstacle is that there is still a great deal of mystique, particularly to the less scientifically literate, surrounding bioremediation and its processes. This lack of understanding can make bioremediation an intimidating prospect to many. The vast majority of literature concerning bioremediation exists in scientific journals, written in a dry academic style that is close to unreadable by the layperson. The bulk of these studies are conducted in highly controlled, sterile laboratory conditions, incredibly different from the diverse, heterogeneous and competitive ecologies that exist in a garden environment.

In order for this boundary to be spanned, a few individuals that are scientifically literate will need to wade through the journals and distill a series of guiding principles and best practices usable by the average gardener. From there, a push needs to made from within and outside of academic institutions to conduct a greater number of field-based trials, where proven bioremediation techniques are put to the test in real-world conditions. Emphasis needs to be placed on techniques that are simple, affordable and that make use of commonly available biological agents. The focus of these studies should be on the top 12 inches of soil, the zone in which the majority of urban gardeners are active. Partnerships between citizen groups and academic institutions are vital, as universities have access to technological resources that gardeners are commonly lacking but are necessary to conduct such trials.

Cost is another significant barrier to implementing bioremediation techniques. While bioremediation is relatively inexpensive, especially when compared to more intensive means of conventional remediation, its use still requires some expenses, particularly when soil testing is involved.

For example, spreading spent mushroom substrate over an oil spill could conceivably be done for little or no cost. Testing the contaminated

soil, however, to be sure that the total petroleum hydrocarbons have been reduced to safe levels can be prohibitively expensive — potentially hundreds or thousands of dollars. While the spent substrate application may have been successful in degrading the oil, without verifiable data to prove its effectiveness it is difficult to get the support needed to replicate the process on a broad scale.

Governmental agencies ideally would play a role in funding citizen-based cleanups, although they have done very little to date. Most of the government funds that exist for brownfield remediation go to large-scale developers, who are primarily interested in meeting regulatory obligations as quickly as possible. These developers typically favor a "dig and dump" approach to soil remediation, rather than dealing with the longer time scale and other uncertainties that can accompany bioremediation. Additionally, many governmental agencies charged with environmental protection are reluctant to work with citizen groups, fearing liability were something to go wrong. Consequently, governmental agencies are commonly unfamiliar with small-scale bioremediation. It is my belief that it is very much in the interest of government agencies to alter this policy. As interest in community gardening increases, so will the number of people wanting to partake in soil remediation. These people are going to attempt remediation, whether or not they receive assistance from agencies. Therefore, it makes sense for agencies to offer some form of guidance or assistance so that people do not put themselves in harm's way.

Part of this work would be developing a solid method of risk analysis for exposure to soil toxins. Currently, no such framework exists. It is important to be able to answer important questions like "what is the danger of being exposed to a particular contaminant in the soil, and further, what is the danger of that being taken up into a plant and being passed into my body?" These aspects of risk need to be weighed against all the benefits of gardening, such as improved nutrition, physical exercise and enhanced community relationships. Developing such a framework is a multi-disciplinary task, involving the fields of ecology, toxicology, public health and medicine.

Developing a protocol for qualitative soil analysis is another innovation that could reduce the cost of bioremediation. It may be possible to create a method for assessing the quality of soils using what are called *bioassays*. An example of a bioassay would be testing seed germination

rates in soils with known levels of toxicity. Using this information, it could be possible to determine contaminant levels in soils using only plant seeds, potentially cutting the cost of soil testing dramatically.

Bioremediation holds great promise for urban gardeners as a tool for achieving improved soil health. Hopefully, in time and with the cooperation of institutional entities, it can go from being an experimental technique to a broadly utilized strategy.

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Before we dive in to the how-to section of the book, there are a few disclaimers and words of caution to be shared.

The Importance of Safety

Your personal safety and that of the people you are working with is incredibly important. Depending on what sort of earth repair and grassroots bioremediation work you are doing, you could be putting yourself in a dangerous situation with potential health risks that could impact your life and the lives of those in the community around you.

A lot of government agencies and professionals discourage community folks from doing this work; they may be genuinely concerned for your well-being and do not believe that you are properly prepared and aware of how to handle such a situation. They do not want folks running into dangerous situations ill-prepared, and this is a legitimate concern and one that you should take seriously.

Your health is important and is as important as this work; besides this work is a lot harder to do if you are unwell. Take the proper safety measures. Wear protective gear if you can. There is more information about what that is later in *Earth Repair*. If you do not know what the risk level is or what you can do to protect yourself, do some research or ask a trustworthy professional. Though be suspect when asking the corporations that caused the problem, as they have a history of downplaying risks and not properly protecting community folks.

Just to be clear — this isn't always high-risk work. It depends on the degree and type of contamination of the site or the nature of the spill you are working with. Please err on the side of caution.

Empowerment and Recklessness

Co-founder of the Rhizome Collective Scott Kellogg warned me about what he called the fine line between empowerment and recklessness when it comes to grassroots bioremediation. Yes it is important to empower folks to get out there to effectively engage in cleaning up, restoring contaminated land and responding to environmental disasters. But we also have to be mindful of getting them all riled up to engage in situations that may be beyond their scope of expertise and present dangerous risks to their health and the community around them. Furthermore, if folks enter into this work on false promises of quick successes and simple solutions, when they face the more complex and messy realities on the ground they will be more likely to give up instead of rolling up their sleeves and shouldering forward.

The truth of grassroots remediation is that it is a far cry from the instant promises of flashy green solutions. Nor is it properly represented in the serene stories of sunflower fields, bubbly brews of compost teas and oil-eating mushrooms. Mushrooms eat oil and help us repair damaged landscapes. It is absolutely correct that microorganisms and some plants can break down chemicals and bind heavy metals. They have always done this powerful work for the planet; it is an essential role they play in the symphony of life and the chaos of catastrophe. But it's just not as quick or simple as some folks make it out to be.

We are working with landscapes and sites that have suffered for a long time, and the pollutants you are working to clean up and the damage you are trying to heal have built up over decades and will not vanish overnight. There is no solution in the remediator's toolbox that can offer that quick fix. Though conventional remediation may offer a few, they are only temporary fixes that clean up one area by shuffling around the contamination to another sacrifice zone, landfill or incinerator. There is no perfect or pure solution, and there are many compromises that we will have to make in this work. That is just the way it is given the nature of the damage we may be dealing with.

We are also working within a system that often does not respect

or encourage the work of grassroots bioremediators (though there are many allies and some places where the system and mainstream power players are experimenting and engaging with this work). You will likely be discouraged from doing it, or at the very least have to jump through many hoops to prove yourself, your project and your plans. Embrace this and use it as an opportunity to make your work better and to clear the trail for those who will follow you.

Be bold but don't be arrogant and underestimate the work involved. Invoke temperance and humility, and ask for help when you don't know what you are doing. Be willing to accept your mistakes and adapt your approach and systems. Create a culture of openness so that we can figure out what is working and what isn't, enabling us to learn from each other's successes and mistakes. Start small and make incremental changes, taking time to observe and allow for room to adapt and shift. If you work in this way, you will have less of a mess to clean up if things go awry.

My Expertise

I am not a remediation professional. I have never worked for any remediation company, been a clean-up worker on an oil spill or remediated a piece of contaminated land. I am on the same learning journey as many of you are and am doing my best to figure out the path. I do so from a place of passion, and with as much awareness for the necessary precautions as I can, given my lack of professional exposure or formal training in this field. My background is in community organizing and environmental issues, permaculture, organic agriculture and herbal medicine. I have an undergraduate degree in Environmental Sciences, which exposed me to some soil science, hydrology and land reclamation, but definitely not enough to be an expert.

A lot of the information in *Earth Repair* therefore comes from interviews I have done with folks who are doing this work in the field, as well as papers and articles I have found. So the information provided is from the experiences of others; I can't promise it will always hold up to be true or effective. As we figure out new and better ways to do things on the ground by attempting the many different forms of earth repair, and as experts open up to sharing more of what they know with the grassroots, I hope that the information provided in this book will be quickly improved by the contributions of others.

Skilling Up to Scale Up

There is so much that we need to learn in order to do this work effectively. We will not become experts overnight, especially if we are too intimidated and overwhelmed to even take that first step. *Earth Repair* is a series of first steps. It's the low-hanging fruits of grassroots bioremediation. The stuff you can do without making too much of a mess or taking on too much risk, that can serve as tools when all other tools are removed from your grasp. And hopefully the thoughts, ideas, tools and stories captured within its pages will inspire you to learn more so that you can become truly effective in whatever piece of this heavy load you decide to take on. Look to the landscape around you and the community that holds you, and then determine what is needed at this time and how you can fill that need as quickly and earnestly as possible. What knowledge and what skills do we need to learn in order to do this work meaningfully and effectively? What relationships need to be built, what mentorships need to be offered or sought out?

It might mean that some of us have to go back and relearn chemistry or soil science, or strike up friendships with those folks who know how to do soil testing and who do professional bioremediation work. It's time for us to step up to that plate. To really consider how we are going to arm ourselves with the information necessary to truly understand what we are up against so we can be as effective as possible in the healing work we do.

Patents, Trade Secrets and the Privatization of Solutions

When I set out to write *Earth Repair*, I was completely unaware that bioremediation solutions and species are being patented. This unsavory reality poses challenges to the grassroots bioremediator. From what I can gather, some academics, scientists, universities and remediation companies have patented certain bioremediation solutions, meaning that they believe (and so does the legal system) they "own" these solutions and the rights to use them.

In the true spirit of disaster capitalism, a lot of companies and individuals are trying to make money off destruction, and some corporations can be quite aggressive with scooping up and patenting new clean-up technology. When it comes to using different bioremediation tools that may be patented, professional bioremediator Robert Rawson

had the following advice: "An individual who is not commercializing something can use any patent out there. You can go online and find the patent library and read up on different patents and see how they did it and try it yourself. There is nothing illegal about that. What is illegal is to take that and start making money off it."[2]

Some folks believe that patents mean that people who want to use them need to either pay patent holders or ask permission, otherwise they could likely sue you. I was told that this isn't necessarily the case, but patents definitely warrant further investigation. Much may depend on the type of patent involved or the possessive nature of the patent holder.

So be leery of whom you do business or share your research with. It's important that we all fight hard to keep bioremediation solutions and living beings in the commons where they belong. At the end of the day, it is wrong for any individual or corporation to say they have purchased or earned the exclusive rights to another living being or to a lifesaving tool. At the same time, we live in a world where corporations can snap up these tools, patent them and suppress them; so many scientists and sympathetic remediation folks are patenting what they discover in order to retain public access.

I also didn't anticipate how my efforts to make available the secrets, recipes and practices of the folks doing the research and the remediation work on the ground would get blocked by the business of it all. The reality is that remediation is a business, and some big companies are in it for maximum greediness and profit, while other smaller companies and professional earth repair folks are in it to make a decent living. Finding experts willing to sit down with me and let me copy their methods down was challenging. Due to the competitive nature of the field, they don't easily share them because if they give out what makes them good at what they do, they are writing themselves out of a job and their business loses its advantage. I understand that, but I wish it were not the case as I don't think it does any favors for community folks on the ground.

Organic vs Inorganic Contaminants (Chemicals/Compounds vs Heavy Metals/Elements)

It is important to keep in mind the difference in working with chemicals versus heavy metals in bioremediation. You need to consider which tools in your toolbox to use, depending on what sort of contamination

you are dealing with. Organic chemicals (such as hydrocarbons and pesticides) can be broken down or transformed while heavy metals cannot. With organic chemicals, you are aiming to break them down or transform them into more benign substances. With heavy metals, you are seeking to either extract them from the soil by isolating and sequestering them so that they can be concentrated in one spot or removed from the site for safe disposal, or to bind them in the soil so that they become less able to be taken up by plants or moved into the water table. You cannot break down or transform a heavy metal; it will always be present, either in a different location or in a less mobile and reactive form. In some cases, you may find yourself dealing with both organic chemicals and heavy metals (for example different fuels and pesticides have heavy metals in them as well as chemicals).

Who Is Who in the Toxic Zoo?

When it comes to cleaning up contaminated sites, understanding what contaminants are present, how they act and their environmental and health impacts allows us proceed as effectively as possible. Knowing what are the major sources of these contaminants also allows us to cast backwards and determine what may be present on a site depending on past uses and activities.

To fully understand how substances act and react is complicated. Some metals are more reactive and move through the soil more easily when the soil pH is acidic, others when it is more basic. Some chemicals leave the body quickly after a person or animal is exposed. Others (like the persistent organic pollutant, DDT) may remain in fat, blood or bones for a long time. Chemical mixtures may be more harmful than the individual chemicals. In oil spill cleanup, it is often the deadly combination of solvents, dispersants, crude and saltwater that can cause severe health and environmental impacts for the environment, nearby communities, clean-up workers and volunteers. Taking a chemistry class wouldn't be a bad idea if you are serious about dealing with contaminants. Finding an ally who has this knowledge would be equally helpful.

Please refer to Appendix 1 for information on different heavy metals and chemicals that you could find on sites you are working with, as well as information on what industries and activities create them and their health impacts. ☞

It is also important to remember that there are different standards for what constitutes acceptable and safe concentrations for each contaminant, and these standards differ from place to place. Some health professionals believe that there are no safe levels for certain contaminants. Due to a pretty strong chemical and industrial lobby, the standards do not always reflect what is best for human and ecological health. When looking at the safe levels of a contaminant, remember that it has been found by some studies that though low levels of certain contaminants in an acute or short-term exposure will not cause adverse impacts, those same levels with prolonged or chronic exposure might.

Permission vs Forgiveness

For folks who like to or have to stay on the right side of the law, you'll want to find out who owns the site you want to remediate and check in with your local city environment office to see what hoops you need to jump through and what approvals you need to get. It will likely involve many meetings and presentations, finding your way around liabilities and through bylaws, regulations and other bureaucratic red tape. You may have to get an engineer or remediation professional to approve your remediation plan. As most earth repair projects take several years, developing a good relationship with the landowner, community and local government helps to lay a strong foundation for collaboration, success and security. However, going this route can also tie you up in a lot of red tape and delay your earth repair work substantially.

Many organizers and grassroots remediators who are doing the work of transforming land from brownfields or greyfields to greenfields in communities across this continent have to work with laws and compromise their pace and approach as a result. This is the on-the-ground reality that no amount of idealism or fist pumping can change. It is a reality that has allowed their projects to succeed and remain in place over time.

I interviewed Mark Lakeman, visionary architect and co-founder of the City Repair Project, which is a community initiative best known for their creative community transformations and reclamations of public spaces in Portland, Oregon, USA. Every year, City Repair puts on the Village Building Convergence, which is ten days of community work parties and workshops on different sites around

Portland, transforming the fabric of the city block by block through permaculture, natural building and placemaking projects. City Repair first started its work with a mobile community tea house installation and then followed that up by taking over an intersection to reclaim and transform it into a village square. They had no permits for either action, and they were definitely not the favorite child of the city administration in the beginning. But today, you'd never know it.

I asked Mark more about how City Repair approached dealing with bureaucracy and what allowed them to develop a more positive relationship. Lakeman explained, "The trick was to get them to identify with our initiative. Every city and town has goals and objectives, like 'let's make the streets safer, slow traffic, etc.' Dig into the website of your municipality, find their vision statement and then find all the language in there which relates to your initiative. Don't just go to them and say 'we are going to sprinkle mushrooms on the ground here' — they won't understand that. If you start with the form and they are not familiar with it, they will react and tend to say no. So first ground the conversation in common goals. Say to them 'there are these five things that the municipality has identified that it wants to do, and we will accomplish all of those things with this project.' Then describe the method or form of how you want to undertake it. Basically you are making a proposal and outlining the way you are going to do it. As soon as a bureaucrat can hold a piece of paper, it all becomes real for them."[3]

If time is of the essence and you are pretty convinced you will receive only opposition and delays from the government, you may want to get all guerrilla with your earth repair, squirrelling away trash, spraying compost tea and planting mustards and sunflowers in your wake. You may choose to proceed without waiting for the bureaucracy to catch up because you are strong and solid with your group and community and feel confident to deal with the government or the company when it butts up against you. You may feel pretty empowered by what you are doing and may be in a situation where you want to set a precedent for the fact that people have a right to do this work — to revitalize community and Earth. If that's the case and you have no faith or taste for government process or recognition of corporate ownership, go for it.

I'm not advocating that you do anything illegal, but if you, your collective or community decide that you need to move forward in a

certain way because of the experiences you've had or the beliefs you hold, then that's your prerogative. Just remember that there are legal risks and health risks. If you want to proceed without permission you will have to take them into account and also bear in mind that potential conflict could result in the untimely end of your project.

Personally, I envision a time in the not so distant future when governments and companies will have other things to do than to focus on who is planting what on which abandoned site, and you as a community of folks who have to live near that site or collect water near it or need more growing space for local food will be able to approach the situation unencumbered by bureaucracy. We aren't there yet, but one day we might be.

In deciding how to proceed, we must question whether the bureaucratic processes that we are being asked to follow are there to help or hinder. Do they create unjust situations that hold the interests of elites and of industries over the health of the planet and the well-being of the people who are directly impacted by the decisions made locally? Or are they legitimately there for public health and safety and because experts are needed in these cases? In the end, every situation is different, and the call is yours to make.

Forward We Go!

Nature has shown us, since the beginning of time, that bacteria, fungi and plants have played their role with true genius when it comes to disaster response, recovery, restoration and regeneration of the planet — just on a different time scale than our modern technological world is accustomed to. At the end of the day, we might not have all the information and assurances we need, but let's view that as a challenge to step up to. It's time to get moving! *Earth Repair* is about doing the best you can as creatively and safely as possible in unfortunate situations given minimal resources and limited information.

The road is made by walking, and the next few chapters are an invitation to pick up the pace and start trying different methods out. To start experimenting in your locality, making mistakes, unearthing brilliant new discoveries, finding our own ways forward and being inspired by the work of others on how to make these earth repair tools ever more applicable and accessible to our bioregions and our communities.