Preserving Biodiversity
As If Life Depends on It

Our survival depends on our ability to protect biodiversity. Someone who lived before the advent of cities and agriculture would have encountered many more –perhaps hundreds more– different species of plants and animals every day. Chances are they would have met some that are now extinct or nearly so. Bison roamed the prairies –which themselves contained hundreds of plant species– but also eastern forests. White bears occasionally ranged as far south as the Delaware River. Skies were darkened for hours or even days at a time by flocks of birds. The forest of eastern North America was united by a mycelial mat from the Atlantic Ocean to the Mississippi River. These species were part of a community with the humans who lived there –species that humans might eat, or provide food for those they ate, or who might even eat them. Then and now, members of the community also interact in more complex ways –microbes in the gut of humans help digest our food, and microbes in the soil help feed plants. Many of the species that were once a part of daily life for people are now gone or very rare. They are gone for many reasons, but mostly because their homes were turned into farms and cities. Many species that enriched the lives of our ancestors are no longer here to enrich ours, but it is not just a matter of enrichment. Without those species, the communities they supported are crumbling. We see the loss of these communities in the proliferation of "invasive species," climate change, and epidemics of disease. No longer are we simply losing "enrichment" –our own survival is now at risk. If we are to survive, we must help the community survive –from the bottom up– starting with the soil.

Organic and chemical-intensive land management feature sharply contrasting approaches to interacting with the biodiversity of the ecosystem in which they operate. This divergence has enormous consequences for the sustainability of life. Recognizing that various land management practices may have different effects on the web of life that makes up the environment is crucial to maintaining the intricate balance and life-sustaining benefits of nature. In this context, local, state, and national land management practices and laws, which can play an instrumental role in conserving biodiversity, often miss the mark and contribute to costly and devastating impacts.

The long historical recognition of the importance of biodiversity in national and international law has given insufficient attention to natural approaches that avoid harm or uncertainties. Risk-based standards in environmental law allow hazards up to limits deemed "acceptable," neglecting the availability of alternatives free of harm. The *Organic Foods Production Act* establishes a national working model for avoiding the reliance on practices and inputs that introduce hazards and threats to biodiversity at any level. Instead, the law affirmatively seeks to protect biodiversity as a precious resource that supports a productive agricultural system and a sustainable environment.

How does biodiversity benefit the community?

Biodiversity is literally the diversity of life. From a taxonomical perspective, biologists have identified approximately 1.8 million species on Earth and estimates are that between 80 and 90 percent of the actual total remain undiscovered or unnamed. (IUCN 2009) Yet, biodiversity is in dire peril. The Earth's rich biological heritage of species, communities, and ecosystems, which has evolved across millions of years, is rapidly deteriorating and in many instances irreversibly disappearing.

In its most general sense, biodiversity refers to the combination of species that share a defined habitat to form a community. The study of ecology (from the Greek oikos, or household) teaches that the species of a community continually interact both directly with one another and indirectly through their effect on the nonliving (abiotic) environment. For example, a native bee pollinating a flower supports biodiversity by facilitating services –fertilization for the plant, nutrition for the insect– that are essential for their survival and reproduction. Similarly, a lichen may be the first species to colonize a rock outcropping, liberating mineral nutrients that enable others to become established. Each species within the biodiversity that shares a habitat contributes to the integrity and endurance of the community as a whole.

More specifically, research strongly indicates that biodiversity promotes productivity, stability, and resilience. In general, com-

What is Biodiversity?

A highlight of the United Nation's (UN) 1992 Conference on Environment and Development, known as the "Rio Conference," was the presentation of the UN Convention on Biological Diversity, which 192 nations and the European Union –though not the United States– have subsequently signed. The Convention defines biological diversity (biodiversity) as "the variability among living organisms from all sources including terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems." (UN 1992)

Biodiversity operates at three distinct levels in natural systems. First, genetic biodiversity exists within every species. Species must maintain sufficient diversity within their collective gene pool for future generations to adapt. Secondly, species biodiversity represents the collection of different species that co-exist as a community within an ecosystem. An ecosystem is a distinct environmental habitat combining interdependent organisms and non-living elements, such as a coral reef or tall grass prairie. In general, ecosystems with greater biodiversity are better suited to withstand disturbance and to recuperate from adverse impacts. Finally, ecosystem biodiversity measures the abundance or variety of adjoining yet subtly self-contained ecosystems within a larger geographic area.

When many people hear the word "biodiversity," they think of the tropical rainforest. While rainforests are one of the most biodiverse ecosystems on the planet, biodiversity is important to many types of ecosystems, from rainforests and reefs, to the soil of a farm or backyard turf.

munities with greater biodiversity generate more biomass (the combined weight of all organisms), are more resistant to environmental disturbances, such as drought, and bounce back more quickly after being affected by such disturbances. Mutualistic relationships, such as the exchange of nutrients that takes place between mycorrhizal fungi in soil and vascular plants growing nearby, can more efficiently allocate resources and spur overall productivity.

Of most immediate importance, from how food is grown to the management of, gardens, lawns and landscapes, parks, forests, and rights-of-way, human decisions concerning management practices have a direct impact on biodiversity. In these contexts, biodiversity is a balance without the concept of "pest," as organisms keep each other in check through systems of support and predation, and the habitat ensures nourishment for all living things. The value of biodiversity as an essential tool cannot be dismissed, since chemical dependency in land management has resulted in organism resistance to synthetic chemicals and increasing costs to society in billions of dollars of crop loss, lost pollinators, water contamination, toxic cleanup, and illness. (Tegtmeier and Duffy 2004; Pimentel 2005)

Biodiversity is a foundational principle in the organization of communities at all levels, from a spade full of organically managed soil teeming with microbial life to a pasture seeded with grasses and forbs to a mature tropical rainforest. Biodiversity shapes the characteristics and capacities of every species and creates the conditions under which all living creatures interact and evolve.

Most notably, agriculture is both a prime cause and essential remedy to the biodiversity crisis. Decisions made to use toxic chemicals in land management or food choices in the grocery store every day are directly connected to the future of biodiversity, and the organic choice offers the brightest prospect for a sustainable future.

Differences in Organic and Chemical-Intensive Land Management

The conservation of biodiversity is both a core premise of organic land management and a specific requirement of organic crop, livestock, and wild crop certification. This compatibility between organic management and biodiversity reflects the primary importance that the original organic practitioners attached to nature as the model for successful agriculture. One hundred years of practice and an increasing body of research have subsequently established that biodiversity can impart advantages in managed systems similar to those it does in the wild. Conversely, chemical-intensive land management practices have moved away from treating biodiversity as an integral component of the production process. By targeting individual species –both as commodities to produce and pests to attack– chemical-intensive land management sacrifices the benefits of biodiversity and jeopardizes the very species that comprise it. The science and policy choices that are used to regulate pesticides are especially deficient in preventing their adverse impacts on biodiversity.

Federal Organic Law and Biodiversity

Organic certification does not have a long regulatory history –the U.S. Department of Agriculture's (USDA) standards only took effect in 2002– but the legal protection it affords biodiversity runs deep. In fact, the statutory definition of an organic production system requires that certified farmers "conserve biodiversity" among their other responsibilities. Certification requires that farmers operate a system that responds "to site-specific conditions by integrating cultural, biological, and mechanical practices that foster cycling of resources, promote ecological balance, and conserve biodiversity." (7 CFR § 205.2)

Organic certification is an especially practical tool for this mandate because it features a systems approach to farm management in which each management practice and material input is evaluated in the context of the farm's overall integrity, and are held to standards that are monitored and enforced. According to the preamble to the standards, "Compliance with the requirement to conserve biodiversity requires that a producer incorporate practices in his or her organic system plans that are beneficial to biodiversity on his or her operation." (65 Fed. Reg. 80550) The organic plan must address every critical management practice including pest, disease, and weed management, soil fertility, and rotations for crop farmers and the provisions for feed and living conditions, including pasture for livestock producers. Certified wild crop operations are held to the same biodiversity standard.

The National Organic Standards Board (NOSB) in 2009 approved comprehensive guidance on conserving biodiversity with a recommendation covering organic system plans as well as material review considerations. The recommendation is designed to maximize the benefit from nature's ecosystem services: pollination, pest control, beneficial predation, advantageous fire, flood and erosion control, nutrient cycling, and improved water quality and quantity. It does this by requiring biodiversity to be evaluated during the review of all chemicals used in organic production. The organic system plan component includes a checklist for biodiversity criteria for both the productive and uncultivated areas on the farm. The criteria include giving consideration to hydrology and the current condition and survival requirements of native species, including insect and birds, invasive species potentially spread by production practices, and concerns surrounding fencing and other pest/predator containment issues. (NOSB 2009)

On cultivated land, maintaining a biologically rich microbial community within the soil represents the fundamental commitment to conserving biodiversity. Additionally, using site-appropriate plant varieties (including the species composition of pastures) and livestock breeds is critical for preserving biodiversity at the genetic level. Management of biodiversity on non-cultivated ground primarily entails maintaining natural habitat, including food, water, and living conditions suitable to nesting and protection from the elements for native species. Buffer zones, hedgerows, woodlands, wetlands, waterways, and riparian zones are all habitats that

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The Impacts of Federal Policy on Biodiversity

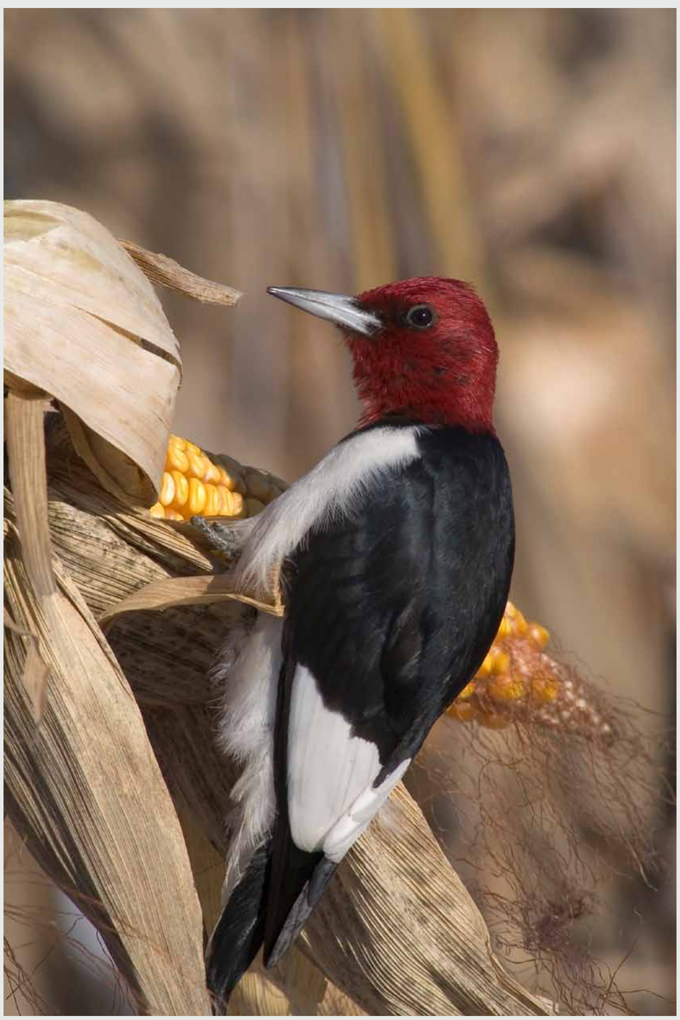
The various federal statutes that could and should collectively protect biodiversity fall short of the coordinated framework that is needed.

The Federal Insecticide, Fungicide and Rodenticide Act

(7 U.S.C § 136 et seq.; 40 C.F.R. Parts 150-189)

EPA's regulation of pesticides under the *Federal Insecticide, Fungicide and Rodenticide Act* (FIFRA) and its "unreasonable adverse effects" standard has minimal focus on protecting biodiversity. FIFRA defines the term ''unreasonable adverse effects on the environment'' as ''(1) any unreasonable risk to man or the environment, taking into account the economic, social, and environmental costs and benefits of the use of any pesticide." The "reasonable certainty of no harm" standard of the *Federal Food Drug and Cosmetic Act*, under the *Food Quality Protection Act*, despite its apparently clear language, authorizes the use of risk assessment calculations that allow for an "acceptable" degree of adverse effects associated with pesticide residues on food in combination with non-food exposures (not including occupational exposure). EPA requires that chemical manufacturers conduct human health, environmental fate, and ecological risk assessments for each pesticide it registers. The pesticide's use profile will determine what types of risk assessments are conducted and, if the pesticide will be used outdoors, an ecological risk assessment will be among them. (7 USC § 136)

Ecological assessments determine the likelihood that exposure to one or more pesticides may cause harmful ecological effects, such as fish kills, bird reproductive abnormalities, or wildlife deaths. According to EPA, ecological risk assessments are done to determine the risks posed by a pesticide and whether changes to the use or proposed use are necessary to protect the environment. The Environmental Fate and Effects Division (EFED) in the Office of Pesticide Programs (OPP) then reviews and evaluates data submitted by the registrant concerning risks to non-target species and makes its recommendations.



OPP does not incorporate comprehensive ecosystem or habitat impacts in its ecological risk assessments. While the agency may look at specific effects that a pesticide has on algae, for example, no further consideration is made to address how the effects on the algae would impact higher trophic members of the aquatic ecosystem, which depend on this keystone species. Secondary exposures to pesticides are sometimes considered, like the exposure of predatory birds to rodenticides. as a result of their feeding behavior. However, broader effects of rodenticides, such as a decline in predatory bird populations or other non-target predators, are not typically incorporated in an ecological risk assessment.

Acute and chronic toxicity tests are performed to evaluate various endpoints, but the effects of sub-lethal pesticide doses are rarely assessed. Sub-lethal effects can occur at very low doses of pesticides, and have been shown to affect reproductive, neurological, and behavioral traits in various organisms, which can ultimately affect ecosystem health and biodiversity.

Incomplete Data

Often, incomplete testing for ecological impacts occurs, and pesticides are registered without a full understanding of the ecological impact, with the agency instead relying on collecting data after the pesticide has done its damage to the environment. In spring 2011, thousands of spruce trees died after the application of the herbicide Imprelis to kill broadleaf weeds like dandelion and clover. In this case the agency negotiated with the manufacturer to withdraw the product from the market, arguing that the product was misbranded. Usually, the agency recommends various mitigation measures, like amending product labels, adjusting application rates or recommending buffer zones requirements to mitigate rather than prevent environmental exposure. EPA grants a "conditional registration" if it deems the data at the point of initial registration to be unnecessary to determining the reasonableness of the risk.

Science focused on incidents not prevention

According to EPA, an ecological incident is defined as an event in which pesticide use is known or suspected of causing the death or other adverse toxicological effect to wild animals and plants other than the intended target species. Information on ecological incidents is available to EPA staff from several avenues, such as the ecological incident information system (EIIS), aggregate incident reports from manufacturers, and the avian incident monitoring system (AIMS). Through these databases, EPA considers "major" incidents of intensive impacts, but fails to consider the even greater impacts of routine pesticide use.

The complex and data-intensive approach to evaluating and protecting individual species and broader communities under FIFRA creates a false sense of security, since the law's acceptance of established levels of risk and damage, coupled with large uncertainties, is fundamentally at odds with the holistic and systemic management approach that is necessary to be precautionary, prevent harm, and protect biodiversity.

The Endangered Species Act and Its Implementation through FIFRA

(16 U.S.C. § 1531 et seq.; 50 C.F.R. Part 17)

The *Endangered Species Act* (ESA) is a valuable tool in averting a crisis in species extinction, but does not preventively enhance biodiversity. ESA is a temporary solution designed to soften the catastrophic effects on particular species of a regulatory system that fails to protect the planet's ecosystems. The Act establishes a framework under which biological criteria are used to identify ("list") species as either "endangered" or "threatened," which are then afforded specific protections. The Fish and Wildlife Service (FWS) of the Department of the Interior oversees listing of terrestrial and fresh water species while the National Marine Fisheries Service (NMFS) in the Department of Commerce manages endangered and threatened species in bodies of salt water.

When a species is proposed for listing as endangered or threatened under ESA, the Service must consider whether there are areas of critical habitat believed to be essential to the species' conservation. Critical habitat is a specific geographic area that contains features essential for the conservation of a threatened or endangered species and that may require special management and protection. It may include an area that is not currently occupied by the species, but will be needed for its recovery. Every federal agency is required to ensure that any actions it funds, carries out, or authorizes will not result in adverse impacts to species on the list or to the critical habitats of those species on which they depend. Private land owners and occupants are also required under ESA to avoid damage to endangered or threatened species.

Under ESA, EPA is required to determine how a pesticide will affect endangered species when that chemical is registered or has its registration reviewed. The law requires the agency to consult with FWS and NMFS for any necessary additional information and analysis. To implement these procedures, EPA's Endangered Species Protection Program (ESPP) utilizes risk assessment tools to evaluate any concerns about effects to listed endangered species.

FIFRA's standard to protect against "unreasonable adverse effects to man and the environment," while broad enough to evaluate and reduce impacts on biodiversity, instead has been used to establish standards of use that result in levels of harm deemed acceptable. EPA's risk assessment process does not function to protect the most vulnerable in biological systems, but institutes restrictions intended to mitigate risks. The mandated consultations with FWS and NMFS could present the opportunity to evaluate alternative practices that would avoid harm to endangered species, but unfortunately has been largely limited to the risk management framework that has so long dominated EPA's approach to regulating pesticides.

"Although federal agencies have routinely evaluated the effects of proposed actions on certain specific resources (primarily wetlands and endangered species) in their NEPA analyses, they have not usually included the full range of effects or the appropriate scale required for adequate consideration of biodiversity."

The failure of current pesticide regulatory procedures to adequately protect biodiversity has prompted diverse coalitions to litigate, in some cases successfully. However, EPA's failure to consult with federal wildlife agencies regarding the impacts of hundreds of pesticides known to be harmful to more than 200 endangered and threatened species is the subject of ongoing litigation. (see Washington Toxics Coalition, et al. v. EPA, 2001; Center for Biological Diversity & PANNA v. EPA, 2011)

Clean Water Act

(33 U.S.C. § 1251 et seq.; 40 C.F.R. Parts 100-149)

The *Federal Water Pollution Control Act*, commonly known as the *Clean Water Act* (CWA), has a strong statement of purpose when it comes to protecting the national waterways and the wildlife that inhabits them: "The objective of this chapter is to restore and maintain the chemical, physical, and biological integrity of the Nation's waters…for the protection and propagation of fish, shellfish, and wildlife." (33 USC § 1251(a)) The word "restore" is particularly notable, as it points toward improvement and not just protection or conservation, like many other environmental laws. It is the intent of CWA to accomplish this restoration by progressively reducing, with the aim of eliminating, water pollution in all its forms. Although important progress has been made toward this goal, the enforcement programs set up by EPA to regulate waterways are often inadequate if the intention is truly to eliminate water pollution in the U.S., particularly with respect to "nonpoint" pollution. Agricultural pollution, including pesticide chemicals, is alarmingly widespread throughout many of the rivers, lakes, and streams across the country. Studies of major rivers and streams document that 90 percent of all fish, 100 percent of all streams, 33 percent of major aquifers, and 50 percent of shallow wells contain one or more pesticides at detectable levels. (Gilliom, et al., 2006) In a 2009 court decision, the 6th U.S. Circuit Court of Appeals found that the National Pollutant Discharge Elimination System (NPDES), outlined in section 402 of the CWA (33 U.S.C. § 1342), requires those spraying pesticides in a manner that discharges into water to obtain a permit. (National Cotton Council v. EPA) However, the "general permit" EPA issued to cover these instances has many limitations. Although the statutory authority is present under the CWA for strong regulation of chemicals and other pollutants in U.S. waterways, EPA's enforcement programs, if left unchanged, will continue to fall short of achieving this goal.

Plant Protection Act

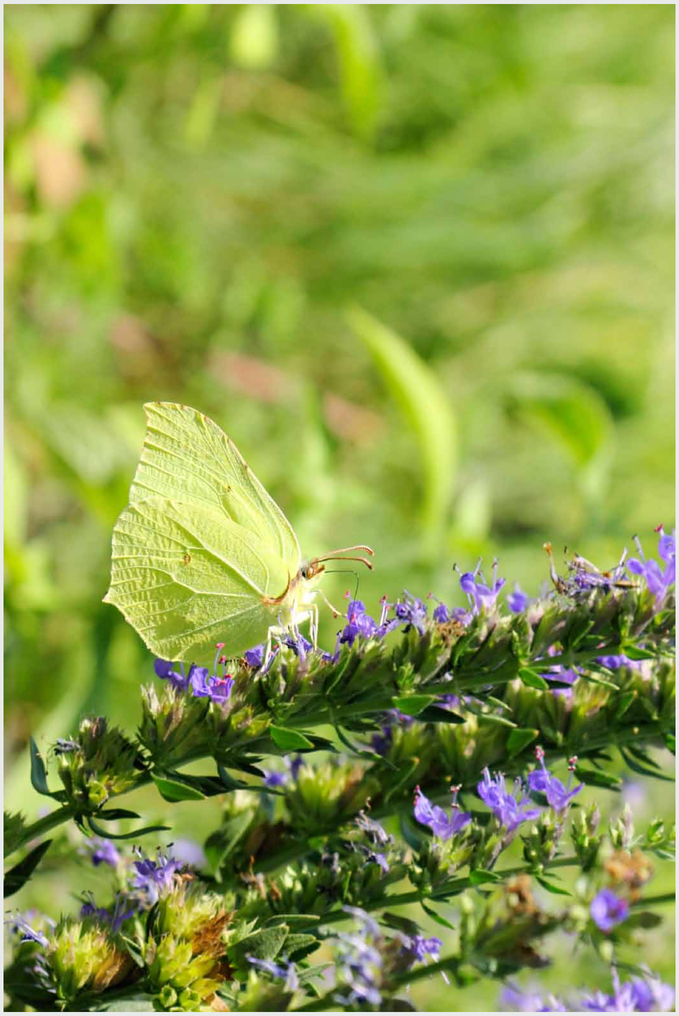
(7 U.S.C. § 7701 et seq.; 7 C.F.R. Part 330)

The explosion of genetically engineered plants in agriculture, including 90 percent of conventional corn and soybeans, cotton, alfalfa, and sugar beets, and introduction in turf grass, contributes to an escalating crisis in protecting biodiversity. (USDA 2011) Genetically modified organisms (GMO) take agriculture further down the road of increased chemical dependency with the proliferation of herbicide-tolerant and insecticide-incorporated plants. Herbicide-tolerant GMOs allow farmers to rely less on manual management of weed issues through crop rotation, enabling them to plant the same crop in the same field year after year, using nonselective herbicides, thus virtually eliminating any semblance of plant and habitat diversity on the farm. The *Plant Protection Act* requires USDA to evaluate genetically engineered plants on the basis that they may pose a risk of becoming or introducing a pest to other plants, but any consideration of the real hazards of GMOs has only occurred because *National Environmental Policy Act* (NEPA) applies to these decisions. There is a stark contrast here between chemical-intensive and organic agriculture, the latter prohibiting the use of GMO.

National Environmental Policy Act

(42 U.S.C. § 4321 et seq.; 40 C.F.R. Parts 1500-1518; 40 C.F.R. Part 6; 7 C.F.R. part 372)

Enacted in 1970, the *National Environmental Policy Act* (NEPA) requires that consideration of any federal government action that may impact the environment includes any potential environmental effects before any action occurs. It requires federal agencies undertaking an action to produce either an environmental assessment (EA) or a more rigorous environmental impact statement (EIS). At minimum, a review must evaluate any impacts which the proposed action might have upon the environment as well as any possible alternatives that could be employed to lessen or avoid those impacts. The consideration of alternatives is one of the most critical and significant parts of the NEPA process. Agencies must give their reasoning for their choice of alternative.



The NEPA process can be highly beneficial for protecting biodiversity if properly applied because it can serve to fill in gaps between policy areas covered by various other laws and connect their respective policy considerations into a comprehensive environmental evaluation. As the White House Council on Environmental Quality (CEQ) stated in its guidance on incorporating biodiversity into NEPA evaluations, "Proper application of the NEPA process can reduce conflicts over resource management now burdening the *Endangered Species Act* by providing a mechanism for consideration of overall ecosystem health issues and of the needs of specific species prior to their becoming threatened or endangered." (CEQ 1993)

While the potential of the NEPA process is promising, the implementation has consistently fallen short. As CEQ noted in 1993, "Although federal agencies have routinely evaluated the effects of their proposed actions on certain specific resources (primarily wetlands and endangered species) in their NEPA analyses, they have not usually included the full range of effects or the appropriate scale required for adequate consideration of biodiversity." The presence of specific regulatory endpoints, such as listing a species through ESA or registering a pesticide under FIFRA, have supplanted the more holistic and comprehensive review procedures established in NEPA.

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organic farmers use to protect biodiversity. Even on small farms in relatively developed regions, vibrant native habitat can provide invaluable support for species on-site and also serve as wildlife corridors for species moving to larger protected areas.

Organic soil: How do organic and chemical-intensive agriculture affect biodiversity?

The most fundamental and ultimately most important difference between organic and chemical-intensive land management is their respective impact on the living network of biodiversity known as the soil food web. Each field, forest, or pasture has a unique soil food web with a particular proportion of bacteria, fungi, and other groups, and a particular level of complexity within each group of organisms. Maintaining a vibrant soil food web with site-specific characteristics resulting from soil, vegetation, and climate factors is crucial for the ecosystem as a whole to function effectively. The soil food web largely determines nutrient cycling and retention, water infiltration, disease suppression and the isolation and breakdown of contaminants to the system. Biodiversity works synergistically within soils to provide these essential ecosystem services, and its decline leads to a cascade of worsening environmental consequences.

From its inception, the organic paradigm has placed the establishment and nurturance of a rich and diverse biological community within the soil as its paramount objective. "Feed the soil, not the plant" sums up the principle of building biodiversity at the microbiological level that originated with organic visionary Sir Albert Howard at the turn of the 20th century. The bacteria, fungi, and larger organisms that surround plant roots, an area known as the rhizosphere, are an especially important community within the broader soil biodiversity. Plants derive almost all of their fertility, including all of their nitrogen, from the rhizosphere and the presence of an active species-specific microbial community is essential for optimal nutrition and performance. In fact, Sir Howard theorized that optimally fed plants sustained by a healthy rhizosphere would be invulnerable to pest and disease pressure and that deficiencies in plant nutrition would create susceptibility to such pressure that would move up the food chain to livestock and humans. Organic farmers and land care specialists continue to build strength and resilience throughout the systems they manage by "feeding the soil."

An 8,500 square mile dead zone has formed in the Gulf of Mexico, not far from the mouth of the nutrient-laden Mississippi River.

Chemical-intensive agricultural and land management practices result in highly adverse impacts upon soil biodiversity. Dependence on fertilization through synthetic nitrogen sources that are "fixed" from fossil fuel feed stocks, such as urea and anhydrous ammonia, are especially damaging because their high salt content is toxic to soil microorganisms. These fertilizers fundamentally disrupt the dynamic between plant roots and soil biodiversity in the rhizosphere. Chemical-intensive agriculture and land management can induce plants to increase their nitrogen uptake, which produces rapid lush growth, but at the expense of overall soil health and long-term productivity. Contemporary chemical-intensive management yields demonstrably vulnerable plant communities that are dependent on an arsenal of pesticides for their defense.

Creating Dead Zones

Perhaps the most extreme example of the downstream effects of chemical-intensive agriculture on biodiversity is the formation of so-called Dead Zones. They are formed when excess agricultural nutrients, especially nitrogen and phosphorus, are washed downstream and accumulate in the calmer waters of an estuary or bay. Algae capitalize on the abundance of nutrients and reproduce in large blooms that deplete dissolved oxygen from the surrounding waters as they die and decompose. Marine life flees or dies as dissolved oxygen drops below the levels they need to survive. With the food chain broken, populations of the avian and terrestrial species that feed on aquatic life also shrink away as biodiversity is extinguished and a once stable and productive ecosystem stagnates.

Chemical-intensive agriculture is intrinsically prone to triggering the formation of Dead Zones because of its excessive nutrient loading and the vulnerability of those nutrients to escape treated land. Spring storms and flash flooding have been especially devastating in the Midwest in recent years where even a conservative estimate places topsoil losses at 5.2 tons per acre per year. (EWG 2011) Fueled largely by agricultural run-off from the Mississippi River drainage basin, the Gulf of Mexico contains the world's largest Dead Zone, which has been measured as large as 8,500 square miles. (LUMCON 2011)

Organic agricultural and land management systems are also vulnerable to nutrient loss through leaching and erosion, but organic practices reduce the risk. Organic farmers and land managers use natural, less soluble sources of nitrogen, phosphorous and magnesium, including cover crops, compost, manure and mineralized rock, that promote increases in soil organic matter and a healthy soil structure. Healthy soil structure allows water to infiltrate the ground slowly, rather than escaping across the surface and carrying soil particles, nutrients, and other inputs with it. Healthy soil structure also allows plants to establish vibrant root systems that resist erosion. Additionally, organic certification requires that ruminant livestock are maintained on pasture that provides a substantial portion of their nutritional needs during grazing season. Well-managed pasture provides year-round ground cover that is the ultimate defense against erosion and a farmer using good rotational grazing practice is supplying non-toxic natural fertilizer as well.

Organic agriculture and genetic biodiversity

The devastating impacts that chemical-intensive agriculture and land management practices have on biodiversity are increasingly being recognized at the ecosystem and global levels. However, a quieter biodiversity crisis unfolding within agriculture today is tied to a combination of new technologies and corporate control that has resulted in the loss of thousands of traditional seed varieties and livestock breeds. The Food and Agriculture Organization estimates that some 75% of crop genetic diversity has been lost over the past century worldwide, as indigenous farmers have switched from local varieties (landraces) to genetically uniform, high-yielding varieties. Similarly, half of all breeds of domestic livestock raised in Europe one hundred years ago are now extinct, and 43 percent of the remaining breeds are endangered. In the U.S., 95 percent of the cabbage, 91 percent of the field maize, 94 percent of the pea, 86 percent of the apple and 81 percent of the tomato varieties cultivated in the last century have been lost. (FAO 1996, 1998)

Why is the precipitous decline in traditional seed varieties and livestock breeds so consequential? Lost along with each traditional variety and breed is the genetic biodiversity nurtured over countless generations with which these plants and animals adapted to the environmental conditions specific to their place of origin. While modern varieties and breeds may promise higher yields under favorable conditions, they almost always require more intensive inputs such as fertilizers, irrigation, and feed supplements to achieve such results. Additionally, traditional plant breeding practices used to develop seed varieties with desirable production and performance attributes –higher yields or better drought and pest tolerance, for example– can only be as effective as the pool of genetic resources available to the breeder. Once lost, the genetic biodiversity in traditional varieties and breeds is irreplaceable. Despite well-funded claims to the contrary, genetically engineered seeds do not match the benefits that traditional plant breeding continues to make available. Certified organic crop and livestock farmers select varieties and breeds suitable to their site-specific pest, disease, and parasite pressures, in the process preserving unique resources of biological diversity. (FAO 1996, 1998)

Conclusion

The urgency to advance organic practices is amplified when factoring in the critical importance of biodiversity to the sustainability of life. Strategies that tinker with risk assessment and establish acceptable thresholds of harm, while giving inadequate emphasis to the impacts on biodiversity and the spiraling reductions in the benefits of healthy and diverse species to effective land management, are short-term and short-sighted. While causing harm to biodiversity, chemical-intensive strategies are not proven to be necessary in light of effective organic practices. Simple reductions in chemical use in chemical-dependent management do not move land management to practices that protect and nurture biodiversity. Organic systems and the federal organic law do.

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