



Ethical Considerations in the Propagation of Medicinal Herbs

By Stephany Hoffelt BA HAS

When I took my first “official” herb course almost a decade ago I was truly unsettled by the number of endangered or exotic herbs I had to order from long-distances to finish the assignments. As my work in the class proceeded, I grudgingly admitted that a few of these herbs were useful and so began an internal struggle over sustainability vs. human well-being that has lasted for many years.

I am not alone in this struggle; one of the most pressing issues facing herbalists today is sustainability. As people are once again accessing traditional healing modalities which utilize plant remedies, the increasing demand for medicinal herbs is taking its toll on native plant life. According to the United Plant Savers organization, “This increased usage along with habitat destruction is causing an ever-increasing shortage of plant resources, including some of our most treasured medicinal species.” (Savers, 2013) United Plant Saver’s stated mission is to protect native medicinal plants of the United States and Canada and their native habitat while ensuring an abundant renewable supply of medicinal plants for generations to come. (Savers, 2013) I believe this can be done by teaching our students to use ethical [wildcrafting](#) practices and by encouraging individual herbalists to grow their own supply of medicinal herbs.

One of the first quandaries medicinal herb gardeners often run into revolves around deciding which herbs to plant, particularly because many of the popular herbs used by herbalist are not native to the US. Native plant enthusiasts are quick to decry those who plant non-natives. It leads to a lot of confusion as to how best to proceed. My personal questions about native vs. non-native plant use led me to explore the issue more thoroughly for my own peace-of-mind. Hopefully in sharing this information, I can help others struggling with the same question.

Nativist Philosophy

The nativist philosophy hinges strongly on the idea that non-native plants are “invasive” and should never be introduced due to their propensity to spread and overwhelm native plant populations. Nativists also have concerns that native insects are dependent on chemically unique native plants and that loss of native plants results in loss of native fauna. (Webster, 2012) The nativists blame human actions such as habitat destruction and predator eradication for upsetting once stable ecosystems. A *Sand*

County Almanac and Sketches Here and There is considered by many nativists to be the definitive work in defense of the preservation of our natural places. Its author, Aldo Leopold, is heralded by many as the first nature writer to propose the idea that human beings are a part of the natural world rather than being distinct from the ecosystem. While previous nature writers such as Henry David Thoreau and John Muir touched on this theme in their writing, Leopold was an academic professor and his lettered credentials undoubtedly bolstered his opinions in the minds of his readers.

Leopold leans strongly towards the preservation of native habitat. Leopold summarizes his land ethic as follows: "A thing is right when it tends to preserve the integrity, stability, and beauty of the biotic community. It is wrong when it tends otherwise." (Leopold, 1949, p. 225) Integrity, according to Leopold, being is synonymous with an emphasis on those plants which have "always" existed in the ecosystem. In his landmark essay, *The Land Ethic*, Leopold issues the challenge that humans are morally and ethically compelled to care for "the land" defining this concept as "not merely soil; it is a foundation of energy flowing through a circuit of soils, plants and animals." [Including human animals] (Leopold, 1949, p. 216).

To carry on his work the Aldo Leopold Foundation has been established. The foundation's mission "is to inspire an ethical relationship between people and land through the legacy of Aldo Leopold." (Aldo Leopold Foundation, 2013) As part of its service the foundation provides information on how to manage invasives as a part of one's land stewardship plan. For instance, they suggest "Spraying garlic mustard with glyphosate herbicide as a very efficient way to control GM populations." (Aldo Leopold Foundation, 2013) This recommendation illustrates the dichotomy between their mission statement and their practices.

Contradictions within the Nativist Philosophy

I already was struggling with the ethics of native vs. non-native herb propagation, before I started my research. The first issue I had with nativist philosophy is my frustration with their definition of native. One article frustrated me to no end with the following statement: "within the category of plants we call 'native,' there is considerable variation in understanding what that term means, but we will leave these finer distinctions aside for purposes of our argument here." (Webster, 2012) That makes no sense at all in this context. Defining "what is native" is germane to the conversation. Many of the basic tenants of the nativist philosophy don't make sense based on my previous studies of plant biology and conservation science.

One of the basic philosophies of nativism hinges on the idea that it is the inherent nature of plants to remain in the same place. Having extensively studied white pine populations in my conservation biology class, I knew this was not the case. A fascinating animation as to how quickly trees migrate had put that in perspective for

me. ^[1] As Timothy Scott, author of *Invasive Plant Medicines*, explained, “Throughout history, plants have been known to continually follow favorable climates and environments. (Scott, p. 33) Plants have also traversed impressive distances by natural dispersal methods such as wind, animals and even water. (Kingsley Stern, 2008, p. 140) One study mentioned instances in which “plant seeds were dispersed by water or animals for distances that ranged from 650 to 1540 km.” (Michael Cain, 2000, p. 1219) Scott also makes the point out that many of the plants considered “native” to the US first grew in other locales and made it to the US due to early nomadic tribes’ habits of carrying seeds, food, and medicine with them in their migrations (Scott, 2010, p. 39) elaborating that “human trade routes, migration lines, and roads are “the most ancient means in which weed plants use humans for dispersal.” (Scott, p. 44)

In plant biology we discussed the origins of agricultural plants and their subsequent worldwide migrations. For example, millet and cannabis both originated in China, but were widely established in the US before European settlement (Diamond, 1999, p. 100). I only had to observe the way perennial plants move around my garden, at will, to grasp the idea of plant migration. I think that many people would be surprised to hear that I’ve never planted a sunflower seed or a poke seed in my yard given the vast numbers the birds have “planted” for me, over the years. I fed my birds dried elderberries all spring hoping that they managed that same magic with the elderberries.

Another tenant of nativism that didn’t mesh with my previous studies is the idea that habitats stabilize. This idea couldn’t be further from the truth. The geological history of the Earth has been one of ecosystems adapting to fluctuating temperatures. The prairies that nativists are trying to recreate were on their way out the door thousands of years ago. The only factor holding them in check was human management. Ecologist Mark Wilson explains, “As climate turned cooler and moister 4,000 years ago, oak savanna and prairie ecosystems were maintained only by frequent fires set by native people to stimulate food plants and help in hunting.” The local people used fire technology to maintain an environment that supported them even when the climate no longer supported that ecosystem. (Hemenway, 2007)

Another dissatisfaction with nativism stems from proponents’ use of chemicals as a means of controlling non-native plants. Having grown up on an organic market farm, I remember being horrified the first time I went to a control event which utilized Roundup®. The organizer, reading from the flyer supplied by the Leopold Foundation, told the volunteers to spray the plant “not with so much spray that the herbicide forms droplets and rolls off” in order to avoid damaging other plants in the ecosystem. I witnessed that these instructions were rarely followed and clearly saw evidence of overspray upon re-visiting the removal site. In what was probably the beginning of the end of my involvement with the group, I started investigating the effects of glyphosate on various organisms, and I came upon several studies which lead me to believe that it has deleterious impact on forest fauna and humans, alike. One

study concluded that “Roundup at environmentally relevant concentrations has lethal and genotoxic impact on *E. cyanophlyctis*; which may have long-term fitness consequence to the species.” (Yadav, 2013) Another “demonstrated adverse effects of Roundup® on DNA of *C. latirostris*” (Poletta, 2009) The most concerning study to me involved *Eisenia foetida* (earthworms), as these organisms play such critical role in soil development that I won’t even let my boys use them as fish bait. Researchers found that:

“Earthworms kept in glyphosate treated soil were classified as alive in all evaluations, but showed gradual and significant reduction in mean weight (50%) at all test concentrations. No cocoons or juveniles were found in soil treated with either herbicide. Glyphosate and 2, 4-D demonstrated severe effects on the development and reproduction of *Eisenia foetida* in laboratory tests in the range of test concentrations.” (Correia, 2010)

There are also studies which document negative impact of glyphosate on human populations including one study which states:

“Glyphosate, the active ingredient in Roundup®, is the most popular herbicide used worldwide. The industry asserts it is minimally toxic to humans, but here we argue otherwise. Residues are found in the main foods of the Western diet, comprised primarily of sugar, corn, soy and wheat. Glyphosate’s inhibition of cytochrome P450 (CYP) enzymes is an overlooked component of its toxicity to mammals.” (Seneff, 2013, p. 1416)

These findings are in pretty stark contrast to the information I have received from the local plant society. I shared my findings on Iowa Native Plants listserv only to be told by one member that “Given the toxicity of the plants in the nightshade family I would be far more concerned about ingesting green potatoes or other parts of the plant than any herbicides.”

Upon discovering so many contradictions, it was only a matter of time before I started questioning whether there was some sort of financial motivation behind the obfuscation of the native vs. non-native debate as is often the case. Toby Hemenway, author of *Gaia’s Garden* mentions that most of our commodity crops are non-natives. The “only food-crops native to North America are sunflowers, hops, squash and some nuts and berries.” (Hemenway, 2000, p. 12) This leads one to believe that socioeconomic uses of the plant also determines its fate. On his blog Hemenway opines:

“Let me tell you about the invasive plant that scares me more than all the others. It’s one that has infested over 80 million acres in the US, usually in virtual monocultures. It is a heavy feeder, depleting soil of nutrients. Everywhere it grows, the soil is badly

eroded. The plant offers almost no wildlife habitat, and since it is wind pollinated, it does not provide nectar to insects. It's a plant that is often overlooked on blacklists, yet it is responsible for the destruction of perhaps more native habitat than any other species... This plant's name: *Zea mays*, or corn." (Hemenway, 2007).

Not surprisingly, it was the agriculture industry that lobbied for most current legislation in place concerning invasives, citing concerns about invasives threatening cash crops. In *Invasive Plant Medicines*, Timothy Scott illustrates the chemical industry's ties to the issue by sharing that the California Exotic Pest and Plant Council was established by a Monsanto executive and companies such as Monsanto have funded a lot of the research on the issue. (Scott, p. 11) In light of statistic that the US spends 34.7 billion dollars a year to eradicate invasives (D. Pimentel, 2000), I can't help but have similar suspicions as these authors that economic motivations cause us to overlook food crops as invasives despite the tremendous havoc they wreak on ecosystems. I even found myself wondering if the war against non-native plants has been sensationalized to line the pockets of corporate farmers and Monsanto executives.

On their website, the Aldo Leopold Foundation contends that *Alliaria petiolata* (Garlic Mustard) is an herbaceous species that moves into forests, overwhelming native species. (Aldo Leopold Foundation, 2013) I found myself wondering how much damage non-native plants have had on native plant and fauna populations and decided to do some investigation of my own. In 2012, the peer-reviewed journal *Forests* published a review that investigated the positive effects as well as the negative effects that invasives have had on native fauna. The authors' stated purpose was to investigate the idea that "classifying invasive plants as either "good" or "bad" for a native ecosystem is missing the big picture." (Hayes, 2012, p. 841) In some cases the authors were unable to find any negative impacts at all. For example, *Lythrum salicaria* (Purple Loosestrife) is an invasive which has been purported to have negative impacts on native bird populations but the authors of the review were unable to corroborate that information, finding instead that the plant had very little effect on native populations. Similarly they were only able to find information about the positive effects of *Rosa multiflora* in providing cover for wildlife in areas that had been stripped of their native plant cover by an out-of-control herbivore population. The review strongly supports the enemy release hypothesis which suggests that when a species, such as the white tailed deer, shows a particular preference for native plants, space is cleared and gives the invasive a place to move in where they have no natural predator. We have definitely experienced that phenomena here in Iowa due to the introduction of *Rosa multiflora* by the DNR. (Owen, 1992). The authors of the review specifically address my *Alliaria petiolata* question, citing researchers who "observed *O. virginianus* apostrophe [white-tail deer] preferentially browsing on native forest plants such as "*Trillium grandiflorum* (white trillium), *Asarum canadense* (wild ginger), *Polygonatum biflorum* (Solomon's Seal) *Arisaema truphyllum* (Jack-in-the-Pulpit) *Sanguinaria canadensis* (bloodroot) and *Hydrophyllum virginianum* (Virginia waterleaf)" allowing *A. petiolata* a

foothold in the understory.” (Hayes, p. 844). The overall findings of the review support the idea that many of the introduced non-natives served the purpose they were originally introduced for, that of proving cover and habitat for wildlife in areas that had been overgrazed. Another meta-analysis set out to prove that preferential pollination of non-natives plants interfered with reproduction of native plants only to find that “individuals of native species can display substantial plasticity that allows the integration of an alien species in the existing plant-pollinator web.” (Anke Dietzsch, 2011, p. 477) Multiple studies cite the statistic that 32% of California’s native butterfly species are now feeding or breeding in non-native plants. (Shapiro, 2003) The research of ecologists, like Mark Davis and University of Maryland researcher Mark Sagoff, have led them to conclude the impact of non-native plants has been exaggerated, as well. Sagoff contends that non-native plants have no more impact on native extinction than “off-road vehicles, hunting, weather, fire, contingent events, pesticides, pollution and many other factors.” (Sagoff, 2005) Davis takes this further stating that “there is no evidence that even a single long-term resident species has been driven to extinction, or even extirpated within a single US state due to competition from an introduced plant species.” (Davis, 2003, p. 481)

Non-natives as an Evolutionary Response

In the book *Invasive Plant Medicine*, Timothy Lee Scott makes the case that non-native plants are in fact nature’s direct evolutionary response to the human disturbance of ecosystems urging us to utilize these plants in our efforts to bio remediate the toxins humans have distributed throughout ecosystems. He states “These plant pioneers essentially create life out of destruction.” (Scott, p. 19) Scott maintains that non-native plants thought to be invasive have advantages over natives in their capacity to be successful. Native plants, Scott claims, are dying out due to pollution. He illustrates how “excess nitrogen in the soil leads to rapid plant growth and a reduction of lignin content in woody plant stems.” This leaves the plant tissue weaker and less able to withstand disease and insects. (Scott, p. 49) The idea that non-native plants are simply those whose adaptations render them more tolerant of the pollutants makes sense to me when I think of how difficult some natives are to get established.

Scott continues to make his case by proposing that invasion is associated with disturbance, and that a majority of these non-native plants rarely intrude on intact ecosystems. To understand the broad scope of his recommendations, you must understand Scott’s idea of what entails a disturbed ecosystem. The picture that comes to mind for many people when thinking of disturbed landscapes is broad expanses of bare soil, perhaps a forest that has been logged or an area which has been cleared for development. Other types of disturbance which are just as compromising but have the disadvantage of being less visible, are pollutants that may have leached into the systems or been distributed by precipitation. Respiration of polluted air by the local flora and fauna also brings pollution into ecosystems.

This broader definition leads one to question if there is truly any “undisturbed” land left on the planet? This is a significant question to consider in light of the effect that Scott mentions pollutants having on native plants: “native plants are easily poisoned and less able to do deal with upheaval having not evolved in a toxic environment, but that the weedy invasive plants cope well and even flourish in the toxic surroundings.” (Scott, p. 21) This begs the question is some sort of ground cover and food source, better than none at all for the native fauna of the area? I worry a bit about what happens to the fauna who have evolved with their environment and adapted to the non-native plants, when we poison the plants in the name of restoration. The answer to that question may be found in the field of managed relocation which is the intentional act of moving species, populations, or genotypes to a location outside a known historical distribution for the purpose of maintaining biological diversity or ecosystem functions as an adaptation strategy for climate change.” (Mark. Schwartz, 2012, p. 733)

Scott also contends that non-native species benefit their ecosystems. He openly encourages the use of invasives in healing damaged ecosystems citing many examples of non-native plants used in phytoremediation projects. Japanese knotweed “flourishes in abandoned copper mines” moving in and beginning to establish and that purple loosestrife and cattails have the capacity to clean water. (Scott, p. 56). Other researchers have made similar recommendation as to the use of plants for this purpose suggesting, for example, that “pea straw in particular represents a low cost, effective treatment to enhance the remediation of aliphatic hydrocarbons in contaminated soils.” (Shahsavari, 2013)

Scott also expresses the opinion “native plants can also benefit from the invasive plants due to their attractiveness to beneficial insects.” (Scott, p. 61) Scott opinions are supported by the work of evolutionary biologist Greet Vermeij who insists that “Invasion usually results in the enrichment of biotas.” (Scott, p. 58) Ironically even Aldo Leopold, the grandfather of the nativist movement, extols the usefulness of a non-native variety of grass in its ecosystem, saying “Cheat reduces the erosion that would otherwise follow the overgrazing that admitted cheat. (This ecological ring-around-the-rosy merits long thought.)” (Leopold, 1949, p. 157) I am beginning to wonder if any of my Native Plant Society acquaintances have ever read the entire book.

As an additional use of non-natives, Scott also proposes that some of these new, hardier non-native plants, which have been found to be analogues of endangered native plants, should be planted and used by herbalists in lieu of the native species. Scott specifically mentions substituting Siberian elm for slippery elm, barberry for goldenseal, and purple loosestrife for eyebright.

I do have some concerns about planting non-natives for the purpose of remediation and use by native fauna. Despite evidence that the problem has been overblown, it cannot

be overlooked that non-native plants sometimes bring with them a new set of problems. Non-native plants are not always compatible with all native species. For instance, while it provides cover and forage for small-seed eating animals, *Lonicera Maackii* (Amur honeysuckle) increases tadpole mortality (Hayes, 2012). Similarly *Phytolacca arundinacea* (Reed Grass) seemed to negatively impact white-footed mouse populations while at the same time providing nesting habitat and cover for various game bird and northern leopard frogs. (Hayes, 2012) There is also conflicting research on the impact non-native plants have on the soil composition-the hypothesis being that non-native species might alter nutrient cycles. One such study concludes: “While we found that alteration of nutrient dynamics is not an invasive trait shared by all of the invaders in this study, it may be a mechanism by which individual species increase invasiveness.” (Lois Perkins, 2011, p. 373) So I can’t embrace indiscriminate introduction of non-natives based on my concerns about these issues.

The Middle Ground: Evaluating Species on a Case-by-Case Basis

In 2011, Mark Davis and eighteen other researchers published a short commentary in the journal *Nature* issuing a challenge to land stewards to rethink their approach to non-native species. The commentary urged planters “organize priorities around whether species are producing benefits or harm to biodiversity, human health, ecological services and economies. Nearly two centuries on from the introduction of the concept of nativeness, it is time for conservationists to focus much more on the functions of species, and much less on where they originated.” (Mark A. Davis, 2011, p. 154) Permaculturist Toby Hemenway suggests a similar middle of the line approach to addressing the controversial use of non-native plants, advocating for a “sensible balance of native and exotic plants in our landscape.” (Hemenway, 2000, p. 12) Unlike Timothy Scott, Hemenway recommends caution in the introduction of non-natives stating: “it is foolish to deliberately introduce a species known to be locally invasive.” (Hemenway, 2000, p. 11) On his website, *Pattern Literacy*, Hemenway also supports the establishment and protection of native habitats for their value as “endangered species habitat, examples of cultural heritage, and a way of preserving planetary biological wisdom.” (Hemenway, 2007)

Hemenway feels that some non-native plants can play a role in the restoration process and perhaps even help stem the advance of non-native plants. He explains that many invasives have very limited role as “short-lived pioneer plants” whose job is to move into disturbed areas and hold soil in place in order to “preserve and restore the fertility of disturbed ground.” (Hemenway, 2000, p. 19) By walking the reader through some basics of ecological succession he illustrates how, by using “pioneer weedscapes” and accelerating succession, we can create a “more mature, less hospitable [to the invasives] landscape.” (Hemenway, 2000, p. 21) Explaining that slowly the pioneer plants are

replaced as the areas of disturbance decrease and that as the number of niches in a mature habitat increases. His premise is that these pioneer plants, if left to do their work, can be shortly (2-3 years) replaced by native herbaceous perennials. The drawback here is that knowing which plants to introduce, and when, requires a significant knowledge of ecological principals and plant behaviors. It may not be something your average home gardener can accomplish without professional advice. Ecologists in the field of managed relocation have developed methods of making integrated risk assessments which take into consideration the appropriateness of introducing a specific non-native plant in a certain bioregion and even its location in that bioregion. (Mark. Schwartz, 2012). For example, blackberries which can become problematic in areas like the Pacific Northwest, can be planted here in Iowa where the spread is controlled by our harsh winters. Likewise an Amur honeysuckle bush should perhaps be removed if it springs up near a waterway where it can impact tadpoles.

Synthesis

As I've mentioned previously, I approached this essay from the viewpoint of a nativist who guiltily and apologetically planted some useful non-natives. As a volunteer for the native plants society here in Iowa, I have spent many afternoons pulling garlic mustard from local woodlands. It was easy for me to fall in with this point of view. Growing up on a market farm in Iowa had a two-fold impact on me in my formative years. The first of which being that I grew up exquisitely immersed in nature. Our farm, *Seven Springs Farm*, was my first love. Her woods were my haven. I chased crawdads in our creek, drinking from the springs that fed her. Secondly, my parents' occupation made me aware of the impact of poor land management since I was old enough to have to help mechanically weed our 3 acre potato patch. Despite the fact that my parents used natural farming techniques, we were surrounded by conventional farms. I witnessed first-hand the destruction of habitat that Leopold laments in *Sand County Almanac*. In fact, my struggle may be a more personal than Leopold's. "Farmer" was an abstraction to be studied by this Yale educated author, not an identity. His attempts at playing farmer on the weekends was a way of life in my family for generations. It was hard for my parents to make that break. I remember almost violent rows between my father and his father. The more conservation science I studied in college, the more I understood the issue. The waving cornfields became a stark reminder to me of the damage we have wreaked on our ecosystem here in my home state of Iowa. Joining the restoration efforts of the nativists seemed to be the only direct action I could take to counter the ecological resulting from generations of unsustainable farming practices.

Hemenway brings up the negative mental impact of "carrying rage" into the garden. I had never really thought about that before. I would add my own concern in that I don't think that it is good for gardeners to carry guilt into the garden either. I have been chided pretty strongly for planting non-natives, even in contained areas in my

garden. I am not the only one. By 1994, food writer Michael Pollan had been on the receiving end of so much criticism by nativists that it led him to quip in a New York Times article that the “new American garden” is henceforth a place that: Grants citizenship exclusively to native plants (any immigrant to be treated as “flora non grata,” with “invasive aliens” subject to deportation) and resembles as closely as possible the “presettlement” American landscape of its particular region.” (Pollan, 1994) It kind of makes one wonder how your modern nativist survives on that diet? It also seems a bit ironic to me that those same people who are spraying poisons in wildlife areas and who are unwilling to address the larger problems wrought on our bioregion by the all-powerful corn lobby [2] managed to make me feel guilty for planting borage to attract bees in a contained area in my garden. I don’t need that emotional dynamic in my life.

On the other hand, I have a strong calling to protect the native plants and re-establish small parts of native habitat. I have decided to direct my focus on working with United Plant Savers using Hemenway’s recommendation of planting gardens that combine natives, food plants, medicinal and culinary herbs, and insect-and-bird attracting species into synergistic, mutually beneficial groupings. In truth, this is what I was already doing but it I have decided to quit feeling badly about it. My husband, an environmental policy major, and I have been building a garden designed to provide for more of our personal needs. Permaculture’s ecological garden techniques are in keeping with our gardening philosophy. Hopefully by developing an increasingly closed cycle in our garden we can continue to reduce our carbon footprint by eliminating the need to haul in mulch, compost and other organic soil amendments. It may also reduce our need for municipal water. Our work has been, and will continue to be, especially relevant to my herbalism pursuits. In addition to bringing me great joy, every new herb I plant cuts my overhead significantly while reducing my carbon footprint. I am guaranteed a supply of fresh herbs with no worries about how long they have been sitting on a shelf or how they were grown. Given the many benefits, I believe that herb gardening, with ecological design in mind, is something that teachers should incorporate into their herb school curriculum and that whenever possible teachers should establish, or have access to, a teaching garden in the community.

As to the issue of my non-native insect habitats, otherwise known as my borage plants, I took Hemenway’s advice and spent some time observing my little ecosystem. My observations led me to believe that the native bees in my garden enjoy the non-native comfrey as much as they do the native goldenrod. In fact, since the golden rod blooms much later in the fall than the other plants in my yard, I feel like I might be doing my bees a favor by supplying them with a consistently blooming, chemical-free haven. I have decided to welcome any form of flora, or fauna, that need sanctuary into my ecosystem. To me that is what feels ethical and respectful of the aforementioned “energy flowing through a circuit of soils, plants and animals.”

[1] Animated migration map at <http://www.ncdc.noaa.gov/paleo/pollen/viewer/>

[2] The Iowa Corn Growers Association (ICGA) and the Iowa Corn Promotion Board (ICPB) Iowa Corn Promotion Board (ICPB) are the two largest groups. The ICGA does lobbying work while the ICPB funds research. The two groups share a website which brings up a lot of questions about ethics and the research the ICPB funds.

References

Aldo Leopold Foundation. (2013, June 20). *Garlic Mustard Management Protocol*. Retrieved from The Aldo Leopold Foundation: <http://www.aldoleopold.org/WoodlandSchool/garlicmustard.shtml>

Aldo Leopold Foundation. (2013, June 20). *Mission*. Retrieved from Aldo Leopold Foundation.

Anke Dietzsch, D. S. (2011). Relative Abundance of an invasive alien plant affects native pollination processes. *Oecologia*, 469-479.

D. Pimentel, L. L. (2000). Environmental and Economic Costs Associated with Non-indigenous Species in the United States. *Bioscience*, 53-65.

Davis, M. (2003). Biotic Globalization: Does Competition from Introduced Species Threaten Biodiversity? *BioScience*, 481-489.

Diamond, J. (1999). *Guns, Germs and Steel*. New York: W.W. Norton.

Hayes, S. H. (2012). Relationship between Invasive Plant Species and Forest Fauna in Eastern North America. *Forests*, 840-852.

Hemenway, T. (2000). *Gaia's Garden: A Guide to Home-Scale Permaculture*. White River Junction, VT: Chelsea Green Publishing Company.

Hemenway, T. (2007, May). *Native Plants: Restoring to an Idea*. Retrieved from Pattern Literacy - Toby Hemenway: <http://www.patternliteracy.com/116-native-plants-restoring-to-an-idea>

Kingsley Stern, J. B. (2008). *Introduction to Plant Biology 11th ed*. Boston: McGraw Hill.

Lois Perkins, D. J. (2011). Plant-induced changes in soil nutrient dynamics by native and invasive grass species. *Plant Soil*, 365-374.

Mark A. Davis, M. K. (2011, June 9). Don't Judge Species on Their Origin. *Nature*, pp. 153-154.

Mark. Schwartz, J. J. (2012). Managed Relocation: Integrating the Scientific, Regulatory, and Ethical Challenges. *Bioscience*, 732-743.

Michael Cain, B. M. (2000). Long-Distance Seed Dispersal in Plant Populations. *American Journal of Botany*, 1217-1227.

Owen, R. G. (1992). *Multiflora Rose and its Control*. Ames: Iowa State University.

Pollan, M. (1994, May 15). Against Nativism. *The New York Times*.

Sagoff, M. (2005, April 4). *Do invasive species threaten the environment?* Retrieved from Property Rights Research:
http://www.propertyrightsresearch.org/2005/articles04/do_invasive_species_threaten_the.htm

Savers, U. P. (2013, 6 June). *United Plant Savers About UPS*. Retrieved from United Plant Savers: http://www.unitedplantsavers.org/content.php/163-about-ups_1

Scott Gilbert, D. E. (2009). *Ecological Developmental Biology*. Sunderland, Massachusetts: Sinauer Associates, Inc.

Scott, T. L. (2010). *Invasive Plant Medicine: The Ecological Benefits and Healing Abilities of Invasives*. Rochester, Vermont: Healing Arts Press.

Seneff, A. S. (2013). Glyphosate's Suppression of Cytochrome P450 Enzymes. *Entropy*, 1416-1463.

Shapiro, S. G. (2003). "Exotics as Host Plants of the California Butterfly Fauna. *Biological Conservation*, 110:413-433.

Webster, K. G. (2012, June 15). *Nonnative invasives: A Problem that Can't Be Wished Away*. Retrieved from Native Plants and Wildlife Gardens:
<http://nativeplantwildlifegarden.com/invasive-plants-in-permaculture/>