



This is the post-peer reviewed version of the following article:

Ryan, J. (2011). Cultural Botany: Toward a Model of Transdisciplinary, Embodied, and Poetic Research into Plants. *Nature And Culture*, 6(2) 123–148.
<http://dx.doi.org/10.3167/nc.2011.060202>

Downloaded from e-publications@UNE the institutional research repository of the University of New England at Armidale, NSW Australia.

Cultural Botany:

Towards a Model of Transdisciplinary, Embodied and Poetic Research into Plants

John C. Ryan

PO Box 175

Inglewood, WA 6932 Australia

(+61) 0421 810 430

jryan9@our.ecu.edu.au

Word count:

9000 (including notes and references)

1 figure used (at back)

Biographical information: John C. Ryan is a PhD candidate at Edith Cowan University in Western Australia. His dissertation titled ‘A Poetics of Plants In Becoming’ invokes the writer-as-botanist tradition of John Clare, Henry David Thoreau and Pablo Neruda to create poetic interpretations of the indigenous flora of the Southwest of Western Australia. He is a graduate of the University of Lancaster’s MA in Environmental Philosophy, and his research interests include ecosophy, landscape writing, human-plant interdependencies and the conservation of medicinal and edible plant species.

Acknowledgements: I would like to thank Edith Cowan University, my Principal Supervisor Dr. Rod Giblett and Associate Supervisor Dr. Lekkie Hopkins for ongoing support and constructive feedback.

Abstract

Since the eighteenth century, the study of plants has reflected an increasingly mechanized and technological view of the natural world, squarely set on the disciplinary divide between the humanities and sciences. In broad terms, this article proposes a context for research into flora through an interrogation of existing literature addressing a rapprochement between ways to knowledge. The nature-culture dichotomy, and more specifically the plant-to-human sensory disjunction, follows a parallel course of resolution to the schism between objective (technical, scientific, reductionistic, visual) and subjective (emotive, artistic, relational, multi-sensory) forms of knowledge. The foundations of taxonomic botany, as well as the allied fields of environmental studies, ethnobotany and economic botany, are undergirded by universalizing, sensory-limited visual structuring of the natural world. As the study of everyday embodied interactions of humans with flora, expanding upon the lens of cultural ecology, “cultural botany” provides a transdisciplinary research approach. Alternate embodied cultural engagements with flora emerge through a syncretic fusion of diverse methodologies.

Keywords: cultural botany, cultural ecology, ecocriticism, transdisciplinarity, embodiment, landscape

It may appear singular, but yet it is not the less correct,
to attempt to connect poetry, which rejoices every where
in variety of form, color, and character,
with the simplest and most abstract ideas.
Poetry, science, philosophy, and history
are not necessarily and essentially divided;
they are united wherever man is still in unison
with the particular stage of his development,
or whenever, from a truly poetic mood of mind,
he can in imagination bring himself back to it.

-Wilhelm von Humboldt (quoted in Walls 1995)

Introduction

Cultural botany poses an alternative to the scientific paradigm for researching the many interdependencies between plants and humans from multisensorial perspectives. As outlined in this article, its theoretical frameworks adopt from critical interdisciplinarity, transdisciplinarity, the environmental and ecological humanities, ecocriticism, and cultural ecology. These fields mediate the “two cultures” split, a rupture between the humanities and sciences identified and responded to by such figures as literary critic Snow (1993), philosophers Heidegger (1977), Berlin (1979), Prigogine and Stengers (1984), Serres (1982, 1995, 2002) and Serres and Latour (1995), and ecological thinkers Gillepie (2004), Leopold (1987), Thoreau (1993, 2000) and Seddon (1972, 2005). Due to their technical orientations, environmental studies, ethnobotany and economic botany offer limited theoretical promise for embodied and poetic research into human and plant interactions. As a consequence, I

expand upon contemporary literature in ecocriticism and cultural ecology to present the possibility of cultural botany as a transdisciplinary research context highlighting everyday human bodily engagements with flora. Within the envisioned paradigm, specific philosophical and poetic pathways for research open towards illuminating commonplace cultural interactions with plants.

The Technicized Plant in the Laboratory of Nature

...cancel first the living spirit out:

The parts lie in the hollow of your hand,

You only lack the living link you banned.

This sweet irony, in learned thesis

The chemists call *naturae encheiresis*.

- Johann Wolfgang Goethe, *Faust* (1801) (cited in Berthold 2004)

Translated as “nature’s laboratory,” Goethe’s *naturae encheiresis* expresses early nineteenth-century European disenchantment with the increasingly reductionistic view of nature in which the living body is dissected into constituent parts, each analyzed and compartmentalized into new disciplines of knowledge. The “sweet irony” is the separation of intellectual investigation and bodily presence, and the segregation of epistemologies congruent with the evisceration of bodies in the laboratory. In 1790, Johann Wolfgang von Goethe, a polymath accomplished in both plant poetics and botanical science, authored the long poem, *The Metamorphosis of Plants*, prior to his more acclaimed *Faust*, to propose his vision of what Miller (2009: xi) describes as, “a fuller integration of poetic and scientific

sensibilities that would provide a way of experiencing nature both symbolically and scientifically, simultaneously.” In this excerpt from *Faust*, Goethe critiques the structures of relation between human enquiry and the living objects of study that have been systematized by taxonomic botany since eighteenth-century Swedish botanist, Carl Linnaeus, formulated his hierarchy of plants.

The purpose of scientific taxonomy is to establish standardized methods of nomenclature to reference the large number of plants worldwide and to show evolutionary relationships between species (Clarke 2008: 57). Goethe’s verses provoke the critical question: how has Linnaean taxonomy affected the sensuous relationship between people and plants, where once the visible parts of a plant along with its gustatory, auditory, tactile and olfactory qualities characterized human perception and knowledge of flora? Bearing Linnaean lineage, a modern botanist, engages with plant life through the use of taxonomic keys and tools of magnification that enlarge, to the eye, the minute parts of plants in order to aid classification. In contemporary plant science, DNA technology further ensures that the code of plant knowledge is transmittable to a worldwide audience of specialists (for example, see Clarke 2008). As technical research, the rigorous investigation of flora tends to engage the structuring methodologies of visual taxonomy. Science, and, more specifically knowledge in service to technology, provide the empirical underpinnings for research into plants in contemporary settings.

Before the seventeenth century, knowledge of plants was intimately linked to the human body through herbal medicine. As multi-sensory phenomena, plants were studied for and classified by their curative virtues, which had direct bearing on human health and sustenance. The therapeutic properties of roots, leaves or flowers encompassed a sensuous system of human corporeal engagement with flora. Before species of plants were systematized into hierarchical, sexually-based Linnaean taxonomies, herbal texts categorized

plants according to their uses, specific locations, physical properties, the season at which their optimal therapeutic value could be attained, and their method of preparation and administration. As Schiebinger (2004: 14) stresses, “knowledge of plants at this time was local and particular, derived from direct experience with plants.” Pre-Linnaean knowledge of flora was more syncretic, culturally integrated and sensuously heterogeneous. Foucault (1972) postulates that, after the eighteenth century in particular, natural observation became pinned to visually perceptible knowledge, excluding taste, smell, touch and “hearsay” for their subjective variability, whereas earlier it had been that:

to write the history of a plant or an animal was as much a matter of describing its elements or organs as of describing the resemblances that could be found in it, the virtues that it was thought to possess, the legends and stories with which it had been involved, its place in heraldry, the medicaments that were concocted from its substance, the foods it provided, what the ancients recorded of it, and what travellers might have said of it. The history of a living being was that being itself, within the whole semantic network that connected it to the world. (p. 140)

In 1653, physician Nicolas Culpeper published *The Complete Herbal*, a heterogeneous text about flora, preceding Linnaean taxonomic classification, but proving commensurate vigour in its attention to the practice of discerning between plants through a sensible conceptual framework (Culpeper 1981). The text is a compendium of knowledge about the medicinal virtues of European flora and their preparation with technical descriptions especially laden with multi-sensory information linking human bodily experience to the attainment of practical knowledge of the natural world. For instance, Culpeper (1981: 313) cautions the user of herbs to exercise sensory powers in discerning between beneficial and deleterious root medicines: “Of roots choose neither such as are rotten or worm-eaten, but proper in their

taste, colour, and smell, such as exceed neither in softness nor hardness.” Moreover, non-visual visceral cues signify unity between the powers of human sense faculties and the therapeutic value of the plants: “Yet you may know when they are corrupted by their loss or colour, or smell, or both: and, if they be corrupted, reason will tell you that they must needs corrupt the bodies of those people that take them” (Culpeper 1981: 312). Enfolded within bodily experiences and physical needs, knowledge systems of plants emerged from multisensoriality, as well as the stories and “hearsay” of regional locales and seasonal particularities of nature and culture. In sum, plant epistemologies were situated, variable, self-determined and corporeally affective.

The post-Renaissance botany of the eighteenth century ushered in abstracted universalized methods of classifying plants based on embedded notions of gendered power-relations. Linnaeus first outlined his sexually based system of classifying plants in *Systema Naturae* (1735), *Fundamenta Botanica* (1736) and *Classes Plantarum* (1738) by identifying differences between the male and female parts of the flower. The organizational system, known as binomial nomenclature (or genus-species designation), sets out to compartmentalize plants according to morphological differences between sexual organs (Schiebinger 2004). Linnaeus’s emphasis on sexual morphologies, where the male parts of the flower determine higher classification categories along the taxonomic chain, encipher and reinscribe the gender hierarchies of eighteenth century Europe (Schiebinger 2004). Additionally, Linnaeus’ system served his “physico-theological” ambitions of promoting the development of Swedish nationalism through natural history (Miller and Reill 1996: 8).

Botanical science universalizes the flora of a region by dis-assembling the organic unity of plants into coded blocks of information that transcend cultural, regional, and linguistic heterogeneity. Elements of taxonomic science, such as Latinate names for genus and species and the modern usage of biochemical assays, technicize the study of flora. For

Cultural Botany 7

example, a contemporary of Linnaeus, Georges-Louis Leclerc, director of the Jardin du Roi, similarly criticized binomial nomenclature for its abstraction and its basis in the miniscule morphological details that would require a field naturalist to employ a microscope to identify a plant through the hegemony of vision (Schiebinger 2004: 28). In other words, Linnaean taxonomic botany operates successfully on a global basis because it formulates research into plants, abstracting living beings from the specific temporal, geographic and ecological conditions of complex habitats. Another contemporary of Linnaeus, Swiss naturalist Albrecht von Haller, argued for the role of geography in understanding flora and that temporal changes over time are as crucial as morphological anatomies fixed in a single synchronic moment of perception (Schiebinger 2004: 16). In other words, the technical abstraction of plants is moreover a-temporal in character.

The universalization of plants, through classification and removal from the temporal flux of biotic systems, is further linked to the ocular framing of plants.. As the major legacy of Linnaeus, taxonomy structures life into visual arrays consisting of reproductive organs. Multisensorial features are excised to create exportable images for worldwide circulation. The core practices of the science of plants exemplify the ordering power of what Latour (1999) refers to as the “synoptic tableau.” Latour (1999: 38) asserts that “once classified, specimens from different locations and times become contemporaries of one another on the flat table, all visible under the same unifying gaze.” Scientific images and nomenclatural names are signifiers of the living bodies of nature. These forms move around the world as “circulating references,” enabling the global construction of knowledge systems (Latour 1999: 38). The locality, particularity and materiality of a plant in its environment are reduced to an impulse for compatibility, standardization and circulation of scientific knowledge. Visual representations linked to classificatory sexual hierarchies following Schiebinger’s argument, may obscure actual, temporal and mutable plants in the field, as well as human

sensory experience of those plants Rather than the multisensorial manifold of flora, form and colour, come to determine the auspices of authentic knowledge.

In Heidegger's terms, science and philosophy both constitute knowledge of the world. Part of his larger project is the interrogation of the epistemological exceptionalism of scientific knowledge production as separate from creative, poetic or artistic forms of knowing. Further, Heidegger's attends to the dangerous technical preoccupation of modern scientific enterprise. "Enframing" (*Ge-stell*) maintains the imagistic rationality of science by correlating the systematic domination of the natural world to scientific objectivity and visual knowledge production (Prigogine and Stengers 1984: 32). According to Glazebrook (2000: 246), *Ge-stell* refers to the "challenging of nature to reveal itself in a determined way" through *a priori* assertions about reality. Scientific objectivity determines the "age of the world picture" (Glazebrook 2000: 246). As if in a two-dimensional portrait, taxonomy enframes the natural world, inducing snapshot perception of a plant and instantiating a living organism in space and time. In the essay "The Question Concerning Technology," Heidegger (1977) describes enframing as a kind of ordering or structuring of the visible, standing in contrast to *poiēsis*, which broadens the possibility of sensory revealing or unfolding. On the one hand, enframing sets forth the rigorous ordering of the world, through the atemporal visual denomination of structures. On the other hand, the *poiētic* revealing of the world entails the culmination of the senses in temporal movement, which is seasonal, specific, relational and multi-sensory, or open-ended. As Heidegger (1977: 311) contends, "enframing, in a way characteristic of a destining, blocks *poiēsis*." Arguably the dominant human mode of interacting with plants, taxonomic Linnaean science centralizes the enframing of plants in a culture-free visual paradigm.

Reconciling the “Two Cultures” Schism

The clashing point of two subjects, two disciplines, two cultures—of two galaxies, so far as that goes—ought to produce creative chances. In the history of mental activity that has been where some of the break-throughs came. The chances are there now. But they are there, as it were, in a vacuum, because those in the two cultures don't talk to each other.

-C.P. Snow [1964] (1993)

Following Heidegger's critique, the enframing of plants entails their removal from the cultural influences that determine their conditions as significantly as biological or ecological factors. Since Linnaeus, the technicized plant parallels the larger story of the standoff between science and the humanities. In his 1882 essay “Science and Literature,” presented initially as a lecture to the Senate House in Cambridge, English poet Matthew Arnold (1882: para. 14), a highly influential literary and social figure in Victorian England, argued that literature “may mean everything written with letters or printed in a book. Euclid's *Elements* and Newton's *Principia* are thus literature.” Arnold envisaged literature as an inclusive term for writing that conveys knowledge of the world, as both *belles-lettres* and technical treatises. In Arnold's view, science and literature need not be the incompatible domains constructed during the Newtonian revolution of natural science, but are rather parts of the well-rounded education of the nineteenth-century citizenry. Nearly eighty years later, novelist and research scientist C.P. Snow would return to the theme of conciliation between the arts and sciences at the same lectern.. Identifying a growing discord between the “two cultures” of scientists and intellectuals, Snow (1993: 61) argued that productive connections between knowledge could be made across the humanities and science divide.

In contemporary thought, the epistemological disjunctions between science and the humanities are further emphasized by Nobel Laureate and physical chemist Ilya Prigogine and philosopher Isabelle Stengers, who argue for a “new alliance” between disciplines. In the view of Prigogine and Stengers (1984: xxix), “traditionally science has dealt with universals, humanities with particulars.” Concerning temporality, the authors observe a binary “between the atemporal view of classical science and the time-oriented view that prevails in a large part of the social sciences and humanities” (Prigogine and Stengers 1984: xxviii). On the “two cultures split,” historian and philosopher Isaiah Berlin (1979: xxvi) echoes Prigogine and Stengers, identifying several qualitative disciplinary oppositions: “The specific and the unique versus the repetitive and the universal, the concrete versus the abstract, perpetual movement versus rest, the inner versus the outer, quality versus quantity, culture-bound versus timeless principles.” Characteristic of the humanities, in Berlin’s assessment, are the specific and the concrete (as compared to the abstracted sexualized hierarchies suggested by Schiebinger), perpetual movement and the inner (as compared to Heidegger’s time-arresting principle of enframing), and quality and culture-bound principles (as compared to Latour’s culture-free concepts of the circulating reference and synoptic tableau).

The work of French philosopher Michel Serres provides an apotheosis of the vision of science as enculturated and of humanities as scientifically inclusive and conversant. According to Girard (quoted in Harari and Bell 1982: xi), Serres’s central interest lies in countering “the prevalent notion of the two cultures—scientific and humanistic—between which no communication is possible.” Serres (Serres and Latour 1995: 29) observes that “philosophers with a good knowledge of the hard sciences and of the classics—armed with rigor and culture—will never be taken in by folly or ideologies.” Envisioning a “two cultures” dialogue, Serres (Serres and Latour 1995: 27-28) argues for greater dialogue and exchange between the science and humanities: “The questions fomented since the dawn of

time by what we call the humanities help rethink those asked today, about and because of the sciences.” Moreover, for Serres, knowledge “transcends academic disciplines and artificial boundaries” (Girard quoted in Harari and Bell 1982: xi). Amongst other terms, the rapprochement is synonymous with “connectedness,” “cross-fertilization,” “cross-breeding” and “mutual enrichment,” approaches embodied by Plato, Aristotle, Lucretius, Leibniz, and Pascal through a kindred kind of syncretic perspective on knowledge (Serres and Latour 1995).

As I have been suggesting, the reconciliation of the “two cultures” rift has consequences for the human relationship to the biosphere. In *The Natural Contract*, Serres (1995: 44) deploys the symbol of the “Northwest Passage” to refer to the place of convergence between scientific and humanities-based knowledge forms. The text itself is stylistically enigmatic and transgressive, eliding categorization as either a discursive treatise or a poetic rumination. For Serres (1995: 44), a new contract between humanity and the Earth would entail a shift in power structures such that “the natural world will never again be our property, either private or common, but our symbiont.” As with Serres, the opening of dialogue between disciplines towards ecological justice and sustainability are themes adopted by other writers on the science and humanities disconnect. Cultural theorist Rod Giblett (2004: 41) asserts that “greening the humanities and the modern condition is an urgent intellectual and political task whose aim would be to establish an ecologically sustainable relationship with the earth.” The “greening of the humanities” would engage a more ecologically conversant literati and, conversely, scientific professionals who are more sympathetic to the methods and perspectives of the humanities. Similarly, environmental theorist Verena Andermatt Conley (1993: 77) suggests the need for a green or ecological humanities: “Ecology has been studied primarily in areas of biology, meteorology, geography, and demography. Less has been said on the subject in the humanities, where its

mention is generally parenthetical.” For Serres, Giblett and Conley, greater cohesion between the science and the humanities will produce higher integration between human cultures and the natural world

Towards Transdisciplinary Ecological Knowledge

Science has been about a search for translation, convertibility, mobility of meanings, and universality—which I call reductionism, when one language (guess whose) must be enforced as the standard for all the translations and conversions.

-Donna Haraway (1991)

In 1637, René Descartes in *Discourse on Method* advanced a method of scientific enquiry based on the processes of deduction and reductionism, the former involving the progression towards logical conclusions and the elimination of all illogical assumptions and the latter involving the breaking up of the world into its constituent parts (Moran 2010). Hence, in the sixteenth and seventeenth centuries, mechanical metaphors explaining the human body as a machine or an engine proliferated along with discrete scientific disciplines, each assigned to study the separate aspects of the world and the body. The twentieth century brought about scientific revisioning of Cartesian dualism, especially with Feyerabend and Kuhn’s ideas of scientific constructivism and epistemological anarchism, which situate science within political and cultural contexts and challenge claims towards impenetrable universal truths, respectively (Moran 2010). During this time, the division between science and the humanities, which upheld the distinction between objective truths and subjective interpretations of the world, became more deeply under question.

However, admonitions about epistemological specialization and the potential for a two cultures dualism have occurred since ancient times and are not entirely debatable since Cartesian dualism, Newtonian mechanics, or the industrialization of science in the twentieth century. For example, the Roman doctrine *orbis doctrinae* reflected the belief that an educated person surveys disciplines, whilst Cicero propounded the concept of *doctus orator*, someone who combines extensive knowledge of the sciences with broad experience of everyday life (Klein 1990). Contemporary attempts to address the gulf between science and humanities are represented by two related, but discrete, forms of thought: interdisciplinarity and transdisciplinarity. The works addressed thus far, which argue for rapprochement between the two cultures of science and the humanities, could be further characterized as interdisciplinary or transdisciplinary in focus. Especially when applied to the study of the environment, these fields of enquiry attempt to challenge the distinctions between objective and subjective knowledge of nature, as well as the prioritization of the empirical reasoning of science over the qualitative constructivism of the humanities. A term first used in the social sciences in the mid-1920s, interdisciplinarity is a field of convergence that reflects a larger contemporary movement to confront the epistemological anxiety of Snow's two cultures dilemma in which the compartmentalization of disciplines constrains the development of integrative knowledge. Endeavoring to address the restrictive consequence of specialization, especially within the academy, and also harkening back to an older, pre-disciplinary state of unified knowledge, "interdisciplinarity" refers to the employment of more than a single discipline in following a research enquiry. The major premise of interdisciplinarity is that the disciplines together form the foundations of interdisciplinarity; the individual disciplines maintain their discrete identities within the theory and practice of interdisciplinarity. Interdisciplinarity, in which multiple disciplines collaborate to produce integrated knowledge streams, will be distinguished from transdisciplinarity, which looks towards enquiry-driven

research gestating syncretic bodies of knowledge. As I will suggest, the dividing line between interdisciplinarity and transdisciplinarity is not fixed and depends on definitions. The two are not mutually exclusive, and transdisciplines will always need the methods established in disciplines whilst disciplines will require thought that is quintessentially transdisciplinary to expand the delimitations of the discipline. The previously discussed works of Michel Serres, for example, exemplify some of the possibilities of transdisciplinary thinking in the disciplinary context of philosophy.

Interdisciplinarity is itself defined variously according to the degree of integration between disciplines and the role of the research enquiry itself. Some definitions of interdisciplinarity verge on what could be known as transdisciplinarity. Moran (2010: 14) defines interdisciplinarity as “any form of dialogue or interaction between two or more disciplines.” Most fundamental to interdisciplinarity, according to Klein (1990: 13), is a “dispersion of discourse” marked by the inclination to place research activities within a broader conceptual system or an expanded field of knowledge. Repko (2008: 6) describes the space between disciplines as “contested terrain.” In Repko’s view, interdisciplinary research gains cohesion through a central, guiding enquiry dealing with questions or problems that amalgamate multiple disciplines cooperatively. Soulé and Press (1998: 399) emphasize that interdisciplinarity is only feasible through engaged formal and informal interactions between disciplines. Interdisciplinary researchers need to understand the languages of other disciplines as an essential premise in creating cooperative research. Interdisciplinary research that is enquiry-driven synthesizes diverse epistemological bases towards new forms of knowledge. One of the primary theoretical concerns of interdisciplinarity is whether the knowledge produced is the proximation, integration or transcendence of discrete disciplines. For Barthes (cited in Moran 2010: 15), interdisciplinarity is more than disciplinary knowledge streams situated side-by-side or collaboratively producing new epistemological forms towards practical

problem-solving, but rather the dissolving of disciplinary classification entirely:

“Interdisciplinarity is not the calm of an easy security; it begins *effectively* (as opposed to the mere expression of a pious wish) when the solidarity of the old disciplines breaks down.” The term “interdisciplinarity,” along with the intellectual terrain it interrogates, is itself contested and, depending on definitions, may be conflated with transdisciplinarity. Repko (2008) identifies three major forms of interdisciplinarity: instrumental, conceptual and critical. Instrumental interdisciplinarity is a pragmatic approach to research and methodology which seeks to remedy actual, technical problems. Conceptual interdisciplinarity is similarly pragmatic in focus but tends to amplify a critique of disciplinary perspectives through its research process. Critical interdisciplinarity goes beyond problem solving through disciplinary cooperation and seeks to dismantle the boundaries between disciplines as an impetus of essential transformation in knowledge production. In this third sense, critical interdisciplinary researchers approach both Barthes’ requisite “dissolution” and the transdisciplinary project of creating independent knowledge forms, not limited by disciplinary borrowing for the purposes of real-world, technical problem solving. As Soulé and Press (1998: 399) argue, “the identity of all disciplines relies in part on a consensus on the body of authoritative works that practitioners consider to be fundamental.” Therefore, a discipline is identifiable through its canon, and a transdiscipline will be trans-canonical, or deconstructive of the canon.

At the heart of transdisciplinary research is critical reflexivity on the theoretical and practical processes of enquiry. Expanding interdisciplinarity beyond its disciplinary allegiances, the neologism “transdisciplinarity” appeared in the 1970s in the works of such scholars as psychologist Jean Piaget, sociologist Edgar Morin and astrophysicist Erich Jantsch to indicate the transgression of knowledge boundaries (Nicolescu 2002). In the nineteenth century, English polymath William Whewell’s concept of “consilience” was a

precursor to transdisciplinary thought and signified the interweaving of knowledge into a new cohesive unity “where disciplines are not juxtaposed additively but integrated into a new synthesis” (Walls 1995: 11). Borrowing from Whewell’s earlier call for knowledge integration, *Consilience: The Unity of Knowledge* by biologist E.O. Wilson (1998) adumbrates a contemporary interpretation of synthesis within biological disciplines and between science and the humanities. Wilson (1998: 8) defines consilience as “literally a ‘jumping together’ of knowledge by the linking of facts and fact-based theory across disciplines to create a common groundwork of explanation.”

Reflecting the concept of consilience, transdisciplinarity responds to the fragmentation of knowledge by disciplinary strictures and is distinguished from—but not antagonistic to— interdisciplinarity and multidisciplinary, which, in Nicolescu’s view, always remain within disciplinary frameworks. Repko (2008) identifies a critical distinction between interdisciplinarity, which relies on the disciplines for their theories and methods, and transdisciplinarity, where a problem or theme becomes the core focus of research and the disciplines are effectively transcended through a diverse battery of methods. Hence, the knowledge forms emerging from transdisciplinary studies are applicable to a broad spectrum of research problems. According to Repko (2008: 15), within the humanities during the 1990s, transdisciplinarity often was referred to as the “critical evaluation of knowledge forms.” Central to the transdisciplinary project is a poetics of the world that reconciles the dualisms of the two cultures divide: “If multidisciplinary and interdisciplinarity reinforce the dialogue between the two cultures, transdisciplinarity permits us to envisage their open unification” (Nicolescu 2002: 100). As such, transdisciplinarity is a contemporary response to the increasing compartmentalization of knowledge, foreshadowed by Arnold and Snow in the nineteenth and early twentieth centuries.

An example from my research into popular aesthetic attitudes towards the indigenous flora of the Southwest corner of Western Australia may further clarify the above exposition of transdisciplinarity (see Ryan 2009, 2010). Questions of nature aesthetics are most typically constrained to the disciplines of philosophy and art history. However, in researching the aesthetics of flowering plants as presented in written and spoken colonial and contemporary representations, I found it necessary to query botanical science, philosophical aesthetics, regional historiography, language theory, ethnography, arts-based research and ecocritical theory. My methodology “botanic field aesthetics” draws from ethnographic interviewing with wildflower tourists and botanists, poetic enquiry as autoethnography and the praxis of field walking at sites of botanical biodiversity. Guided by the central question of aesthetics but using a transdisciplinary approach, it has become clear to me that aesthetic perceptions of flora are omnipresent in popular culture and academic literature alike. In this context, transdisciplinarity parallels the broader complexity of the world in which research is situated; it engenders in the researcher an almost constant critical awareness of how disciplinary boundaries might inhibit the following of a research circuit that weaves into the fabric of the world. I assert that transdisciplinarity is inherently more than the assemblage of disciplinary methods for real-world problem-solving; it is *a priori* a theoretical and methodological approach for expanding the bounds of research towards indeterminate patterns and trends rather than fixed answers.

Interdisciplinary studies of the environment and ecological issues characterize the field of environmental studies, which focuses on the study of human interactions with the environment, but the question of transdisciplinary environmental knowledge remains open for interpretation and further theoretical elaboration. The field of environmental studies gained popularity in the 1960s as a result of the conservation movement, spurred by such works as Aldo Leopold’s 1949 book *A Sand County Almanac* and Rachel Carson’s 1962

work *Silent Spring* in the United States, which warned of impending environmental catastrophes and advocated a greater unification of human and ecological concerns. Academic environmental studies programs responded to the realization that ecological problems are “fractious, refractory, and expensive” (Soulé and Press 1998: 398) and defy purely scientific or technical approaches. The interdisciplinarity of environmental studies tends towards instrumental and conceptual approaches, as outlined above, where practical concerns of conservation or policy-making require the perspectives and methodologies of different disciplines. Within environmental studies, the tensions of identity crisis and divergent ideologies aroused by interdisciplinarity have resulted in great variety amongst academic programs, stressing variously the fields of environmental science, policy and planning and cultural studies. At the core of the debate are the differing theoretical and methodological stances of the two major fields of environmental studies: social criticism and natural science. As Soulé and Press (1998: 400) claim that “the second major group—natural scientists—rarely equate intuition (or narrative) and knowledge.” Just as environmental problems themselves are fractious, so is the field of environmental studies internally fragmented by “two cultures” ideology.

The inter- or transdisciplinary study of plants, rather than environments as a whole, has been mainly confined to the fields of economic botany or ethnobotany. The transdisciplinary potential of botanical enquiry is limited by the technicization of these fields through scientific methodologies. Ethnobotany uses both qualitative and quantitative strategies drawn from anthropology and botany to understand the usage and perception of plants by human cultures. In 1895, the American botanist John William Harshberger proposed “ethnobotany” as the study of plants used by traditional people (Cotton 1996). Ethnobotany borrows interdisciplinarily from social science and botanical science for researching human-plant interdependencies (Martin 1995). *Ethnobotany: A Methods Manual*

(1995: 3) by Martin enumerates the affiliated fields constituting ethnobotany as botany, pharmacology, anthropology, ecology, economics, linguistics and conservation science. In Martin's assessment, these six related fields strive towards four major objectives: documentation of botanical knowledge; quantitative evaluation of the use and management of botanical resources; experimental assessment of the benefits derived from plants; and applied projects that seek to maximize the value that people derive from the botanical knowledge. Economic botany is a specific subset of ethnobotany that stresses the economic benefits of local plant knowledge and botanical conservation (Martin 1995: 172). Clarke (2008: 150) discerns between economic botany as focused on industrial uses of plants and ethnobotany as concerned with indigenous people's interactions with plants. At the centre of economic botany is the prerogative for local, indigenous medicines to achieve status as global commodities.

The progression in the interdisciplinary study of plants and the environment has involved the second field—including cultural studies, social criticism, literature, and philosophy—branching off into what has been referred to as the environmental or ecological humanities. In these fields, integration between science and the humanities is realized outside of the dictums of scientific discourse and the inherent dualisms of constructing a technical object of knowledge. The environmental humanities, as defined on the program page of the University of Utah, which launched in 2007 one of the first graduate programs dedicated to the emerging field of study, engages “broad-based understanding of social, cultural, ethical, historical, communication, and literary perspectives...with a focus on how these humanities perspectives intersect with and influence public policy, scientific, legal, industrial, and corporate concerns” (The University of Utah 2009). The environmental humanities assert that ecological problems have resulted, in part, from a form of thinking that posits the

environment as external to culture. Inherent to the environmental humanities is a critique of classical science's replication of dualistic thinking in its approach to ecological issues.

Within Australia, the environmental humanities have taken the more theoretically fleshed out form of the ecological humanities, first outlined by Deborah Bird Rose and Libby Robin. The ecological humanities set out to ameliorate the arts and sciences divide towards greater ecological sustainability. According to Rose and Robin (2004), the ecological humanities address "the great binaries of western thought" and ecological issues are "situated across the nature/culture divide." An ontology centered in connectivity synthesizes Aboriginal, embodied, and post-modern feminist knowledge, as well scientific discourse emerging from researchers such as Prigogine who cross-cut the science and arts distinction towards connectivity and uncertainty. Griffiths (2007) outlines three techniques of humanities research that enhance the scientific study of environments and ecological issues: scales of space and time, storytelling and science as subject. In sum, the humanities augment the scale of science towards "human-scale geographies" and bring narrative forms towards a self-reflexive process of research (Griffiths 2007). In the ecological humanities, environmental transdisciplinarity is nascent.

Poeticizing Plant Research: Floral Poetics

Science is often like the grub, which, though it has nestled in the very germ of the fruit, and so perhaps blighted or consumed it, has never truly tasted it.

-Henry David Thoreau (2000: 242)

A poet follows fleeting insight into the natural world that may be unrepeatable, and often is non-linear and unstructured. Science is thought to hold empirical reason, whereas the humanities deal with the highly variable subjective states of culture. Such epistemological

dichotomies, articulated by Snow, face the ecological transdisciplinary. A fruitful framework encompassing the dialogue between botany and the humanities, and particularly between plant research and poetry, is offered by ecocriticism. According to Moran (2010), ecocriticism is a field that melds the concerns of cultural and literary criticism with those of the natural sciences and geography towards the purpose of ameliorating the conceptual differences between nature and culture. Glotfelty (cited in Garrard 2004: 3) defines ecocriticism as “the study of the relationship between literature and the physical environment...ecocriticism takes an earth-centered approach to literary studies.” The field focuses on the interconnections between cultural forces and natural phenomena, but also on the appropriation of nature by human activities and the proliferation of hierarchical power dynamics between non-humans and humans.

Yet, ecocriticism may serve literary disciplinarity rather than the enquiry-driven, transdisciplinary study of plants. Beyond ecocriticism’s auspices, several writers evidence a fuller integration of poetics and botanical science through what might be called, borrowing Berthold’s term, “floral poetics” (2004: 206) that exceeds disciplinary boundaries and becomes a transgressive vision of the environment and plants in which science and poetics, as conventionally quarantined disciplines, intermingle. This section describes three major writers who sought, as Serres says, both “the scientific ideal and literary temptation” (Serres and Latour 1995: 29), especially between botanical science and poetry. The writers featured here include the philosopher and ecologist Henry David Thoreau, the prose writer and conservation biologist Aldo Leopold and the Western Australian essayist and polymath

George Seddon.¹ Thoreau, Leopold and Seddon evidence literary approaches to plants that are guided by research questions themselves rather than the demands of their disciplinary alliances. Their works exemplify both poetic and scientific visions of the environment and flora that go beyond the fields of environmental studies, ethnobotany, economic botany, and even literary ecocriticism.

Nineteenth-century American philosopher and naturalist, Henry David Thoreau, in his floristically-minded, posthumously-published works *Faith in a Seed* (1993) and *Wild Fruits* (2000) evidences a poetic vision of plants that culminates his transdisciplinary Humboldtian view of science and literature. Walls (1995) characterizes Thoreau as a paragon of post-disciplinary practice who sought transcendental consilience amongst disciplines through the medium of language. As Walls (1995: 13) eloquently argues, Thoreau's writings are particularly embodied versions of botany in which the author "celebrates not the crash of metaphysical dualisms but the murmur of multiple voices and actions, not the ecstasy of transcendental disembodiment but embodiment's perilous and bittersweet joys." Thoreau produced a salient transdisciplinary metaphysics of plants through embodied poetic approaches incorporating vivid sense-rich experience, over the seasons and grounded within a place: the environs of Concord, Massachusetts.

Meticulous observation of broad, diachronic multi-sensory patterns of flora in Thoreau's botanical works position him as an apotheosis of the poet-botanist literary genre. Bradley Dean (2000: xi) comments that "the observations he recorded in his journal ranged from the most purely objective and scientific to the aesthetic and highly subjective."

¹ A more extended treatment of the subject would include such figures as the German poet and botanist Johann Wolfgang Goethe, the English poet John Clare, or Chilean poet Pablo Neruda, all of whom shift between the science and poetry divide.

Thoreau's aesthetic-poetic interpretations of plants intersect with the botanical knowledge of his day to produce accessible works that simultaneously enlarged the boundaries of botany and situated the human body within the inquiry. Importantly, Thoreau preferred the "natural" system of botanical classification, developed by Antoine Laurent de Jussieu and publicized in 1831 through John Lindley's *An Introduction to the Natural System of Botany*, over the Linnaean "artificial" system, the former using a broader spectrum of characteristics to define botanical groups and the latter focusing on sexual anatomies, especially stamen and pistil numbers (Walls 1995).

Thoreau is exemplary of a cultural botanist, a transdisciplinary who invokes literary metaphor, cultural analysis and experiential context in the expansion and occasional critique of the science of plants. His botanical oeuvres suggest that the edges between poetics and science, rather than antagonistic or mutually exclusive, overlap. Thoreau's later works crystallize his achievements as both an amateur botanist and a writer of poetic prose, reconciling the "two culture split between literature and science" (Richardson quoted in Nabhan 1993: xii). Thoreau's writings further evidence the early germination of "literary ecology" in North America (Nabhan 1993: xii). His writings foreshadow the opening of a transdisciplinary space for exchange between the arts and science in the study of plants, whereby that which can be tasted, heard, touched or smelled is not subordinated to that which can be seen.

Perhaps as a reaction to the increasingly technical science of plants, Thoreau's field approach is ostensibly multi-sensory and bodily-present, with ruminations on the olfactory, audible, gustatory, palpable and visual qualities of the Concord flora. Non-visual sense experience constitutes a "bodily eye" (1993: 26). The olfactory faculty perceives plants for their trademark smells, with white pines possessing a "strong spirituous scent, almost rummy, or like molasses hogshhead, which would probably be agreeable to some" (1993: 39).

Thoreau (1993: 143) records audible particularities of plants, as hickory forests echo “even in August...the sound of green pignuts falling from time to time.” The sense of touch reveals information about a cranberry plant—“I was obliged with my finger carefully to trace the slender pedicel through the moss to the vine, where I would pluck the whole together, like jewels worn on or set in these sphagnous breasts of the swamp” (Thoreau 2000: 167). Additionally, Thoreau (1993: 87) attends to the intermixture of the sensory qualities of plants, for example, with the thistle, whose inner silky seed capsules are guarded by a prickly external involucre: “It is a hedge of imbricated, thin, and narrow leaflets of a light brown color, and beautiful glossy like silk.” His prose blends scientific acumen with nuanced poetic perception, and, as works of cultural botany, Thoreau’s writings are *poiētic* expressions of plant life over the seasons.

Thoreau’s embodied transdisciplinary investigations heralded advances in the disciplinary field of plant ecology. *Faith in a Seed*, for instance, is concerned almost wholly with the dispersal mechanisms of seeds, and, with *Wild Fruits*, forms part of his larger unfinished project, the “Kalendar,” in which he aimed to record all the events of natural history that took place in Concord during a calendar year (Dean 2000). Representations of plants express Thoreau’s inherently seasonal approach to studying them, discerning and colligating diverse sense impressions and discursive deductions over time, rather than fixating on visual instances of apprehension based solely on form and color or reproductive isomorphisms. Thoreau assembles a whole life pattern of flora, instead of isolating events in the broader cycle of plants. Through this fusion of careful empirical observation and tonal sensory experience over time, *Faith in a Seed* provided evidence to contradict to the prevailing nineteenth-century belief in the spontaneous generation of plants, and demonstrates, to the contrary, that the distribution of seeds occurs through a variety of subtle mechanisms by birds, quadrupeds, wind and the actual bursting forth of the seed from its pod.

Along similar lines, twentieth-century American biologist and author Aldo Leopold's seminal work on landscape conservation *A Sand County Almanac* published first in 1949 outlines a poetic and metaphysical view of science and nature, and, with a tone of urgency, an imperative that science must assume an increasingly poetic and less reductionistic interpretation of conservation. In the structure of the text, *A Sand County Almanac* reflects Leopold's attempt to integrate poetic and scientific understandings of the natural world. Part I presents a series of essays sequenced according to the twelve calendrical months, while Part II gives a series of geographically organized dirges, elegies, meditations, and more scientifically grounded proclamations. The book culminates in Part III with a series of analytical essays setting out Leopold's concepts of land ethics, wilderness and aesthetics. As Berthold (2004: 207) observes, "the odd structure of the text—its shifting styles and tones, its unsettling pattern of self-translation and self-transfiguration—is in fact central to Leopold's project of developing a style which would mirror his vision of a transgressive integration of science and poetics."

In Part II, the essay "Song of the Gavilan" demonstrates that, at the heart of Leopold's poetic science, is the elision of subject-to-object structures between culture and nature. In the opening of the essay, Leopold distinguishes trenchantly between the song of the river and the instruments of science, which have yet to either disturb or appreciate the river's natural glissando. The river exists in an idyllic, pre-scientific state in which the non-human denizens of the Gavilan are the original botanists of the river, performing empirical studies of its composition: "Open the crop of a fat little Mearn's quail and you find an herbarium of subsurface foods scratched from the rocky ground you thought barren" (Leopold 1987: 151). Whereas the quail reveals the fecundity of the ecosystem "you thought barren," science interrupts the cadence of the world through "an ironbound taboo which decrees that the construction of instruments is the domain of science, while the detection of harmony is the

domain of poets” (1987: 153). Rather than attuned to the melodious river, science is preoccupied with the “process of dismemberment.” That the health of the river partly depends on the “perception of its music” is a reality not yet validated as part of an objective and empirical position (1987: 153-154). Berthold (2004) characterizes Leopold’s acerbic position on science as a call “upon science to open itself to a metaphysics—a way of seeing beyond or above the characteristics of things as self-enclosed phenomena.” His metaphysics is a poetics of fauna and flora in which seeing becomes “an inherently aesthetic act” (Berthold 2004: 212). For Leopold, seeing is not merely a visual act of apprehension but begins with the other perceptual faculties, those that elude science. The scientific vision of Leopold is fundamentally an embodied sojourn through the senses in which the distinctions between humans as land managers and nature as managed object blur indeterminately.

On the other side of the world, twentieth-century essayist and polymath George Seddon's landmark study of Western Australian place, titled *Sense of Place* (1972), is a transdisciplinary exegesis on place as a fusion of the geography, geology and botany of the Swan River region in which Perth is situated. Seddon’s vision of science and the humanities takes the form of an inquiry into West Australian place as both a centre of human commerce and geophysical expansion, as a field of natural and cultural history and non-human interdependencies. Tyrrell (2005: 752) observes that “place and identity are of key importance in Seddon's work...He has strong affinities with local landscapes, as historical interactions of people and land.” Seddon’s *The Old Country: Australian Landscapes, Plants and People* (2005) provides interpretations of elements of regional botanical science, including the vast *Banksia* genus, but imbues these factual recitations with cultural histories that unearths the embedded poetics of plant names. Hence, whilst Seddon’s works exclude the overt scientific poetics of Leopold or Thoreau, they do suggest greater unities between science and the humanities. Moreover, Seddon is concerned with the multi-sensory

dimensions of the flora that can only be communicated in a prose rather than a scientific form. He begins with “scents, sights, sounds – all can stir memories” (Seddon 2005: 128), and then recounts, in poetic fashion, an aspect of the ecology of local acorn banksia:

As I write, in the scorching February of a Perth summer, *Banksia prionotes* is in flower along road and rail reserves, and in odd pockets of bushland and park. The inflorescence is at first a creamy white, but as the individual flowers open, moving up the cob, their brilliant orange colour is revealed, showing the reason for the popular name, the acorn banksias. (129)

Hence, for Seddon, plant ecology is linked, to quote Serres again, to “literary temptation,” aesthetics, poetics, naming and first-person experience. His writings provide regional examples of a trained scientist who bridges the rift between the two cultures in the tradition of Thoreau and Leopold.

Cultural Botany: Bridging Two Cultures, Building on Cultural Ecology

I have attempted to assert that a less fragmented research paradigm into human and plant interdependencies is not to be located within the models of environmental studies, ethnobotany, economic botany, or even in the form of interdisciplinarity where disciplines cooperate, but retain their identities and consequently restrain the enquiry with methodological ideology. Cultural botany is a transdisciplinary model attempts to fuse the arts and sciences divide, offering the possibility for enquiry-driven research into plants to attain embodied, poetic character; such research enables poetry and the human multisensorial to infuse the way in which humans perceive plants. In its most general form, cultural botany encourages exchange between the arts and sciences to expand knowledge bodies. Cultural botany embraces knowledge bases and techniques of enquiry into plants that integratecultural

involvement with flora. As the transdisciplinary study of plants, cultural botany embraces literature, poetry, the visual arts, cultural studies and the humanities as a whole.

Dialogue between poetic language and taxonomic nomenclature, science and the humanities, aesthetics and techniques provides the groundwork for mutually reinforcing efforts amongst researchers of the cultural dimensions of plants, rather than the time-worn debate of disciplinary difference.. As the term “plant” itself is a product of the scientific vision, researchers into flora will necessarily be confronted with taxonomic discourse. In recognition of the possibility of consilience, cultural botany evokes botanical science, employing its technical terms and acknowledging its limitations, while the science of plants pursues an increasingly poetic and enculturated view of the world. Cultural botany furthermore strives to reconnect with the diverse knowledge systems of plants that have been subordinated to a universalised model of plant life. These include Aboriginal and folk understandings.

Recent efforts in cultural ecology—the study of the interactions between human societies and landscapes—offer a promising precedent from which the cultural botany research platform can be advanced. Recent research in the cultural ecologies of plants points to this possibility of cultural botany as an approach for exploring embodied engagements with wild plants. This literature suggests the use of transdisciplinary methods for articulating human interdependencies with cultivated flora. Head (2007: 843) proposes the use of “a battery of diverse methodologies” for researching the cultural interstices between plant communities and humans. Similarly, Hitchings (2003) employed ethnographic to research to understand the perceptions of the materiality of cultivated plants in London public gardens. Moreover, Hitchings and Jones (2004: 8) used mobile interviews, or interviews and field observations performed while strolling with the public amongst living flora. Mobile ethnographic practice facilitates bodily interaction with plants that introduces taste, smell,

touch and sound into floristic research, or what I have called a transdisciplinary practice of cultural botany Head and Atchinson (2009: 239) detail several studies in which interviewing methods allow people to “talk about or demonstrate everyday embodied interactions with plants.” The accounts of corporeal involvements are more intimate and multisensorial than those offered by empirical biogeographic or social science methods (Head & Atchinson 2009).

[Figure 1: Tenets of Cultural Botany]

To summarise, embodied and poetic research into conceptual and practical issues concerning human and plant interdependencies, such as the appreciation of wild flora, calls for a context, building upon research into the cultural ecology of plants. The prevailing models for plant-human research are largely contained within ethnobotany or economic botany. Yet, as previously argued, the limitations of those models highlight the need to synthesize trends in critical interdisciplinarity, transdisciplinarity, ecocriticism, and cultural ecology towards inquiry-driven plant research (see Figure 1). The research context of cultural botany will draw closely together the ethnographic and spatial methodologies of the social sciences, the analytic and textual strengths of the humanities, and the taxonomic and ecological understandings of botanical science towards a more-rounded and multi-faceted articulation of the knowledge flows between human cultures and plants. This article has aimed to circumscribe the theoretical underpinnings of cultural botany, particularly understanding how it might be positioned in the strata of environmental disciplines, such as the ecological humanities and ethnobotany, that address the science and humanities binary. Having drawn the circle widely, a specific example of cultural botany research would be the subject of further enquiry.

References

Andermatt Conley, Verena. 1993. Eco-Subjects. In *Rethinking technologies*, edited by V.

Andermatt Conley. Minneapolis: University of Minnesota Press.

Arnold, Matthew. *Literature and science* 1882. Available from

<http://homes.chass.utoronto.ca/~ian/arnold.htm>.

Berlin, Isaiah. 1979. *Against the current: Essays in the history of ideas*. London: Hogarth Press.

Berthold, Daniel. 2004. Aldo Leopold: In search of a poetic science. *Human ecology review* 11:205-214.

Clarke, Phillip. 2008. *Aboriginal plant collectors: Botanists and Australian Aboriginal people in the nineteenth century*. Dural Delivery Centre, NSW: Rosenberg Publishing

Cotton, C.M. 1996. *Ethnobotany: Principles and applications*. Chichester: John Wiley & Sons.

Culpeper, Nicholas. 1981. *Culpeper's complete herbal and English physician*. Manchester, England: J. Gleave and Son. Original edition, 1826.

Dean, Bradley P. 2000. Introduction. In *Wild fruits: Thoreau's rediscovered last manuscript*, edited by B. P. Dean. New York and London: W.W. Norton & Company.

Foucault, Michel. 1972. *The order of things: An archaeology of the human sciences*. London: Tavistock.

Garrard, Greg. 2004. *Ecocriticism*. Oxfordshire and New York: Routledge.

Giblett, Rod. 2004. *Living with the Earth: Mastery to mutuality*. Cambridge: Salt.

Glazebrook, Trish. 2000. *Heidegger's philosophy of science*. New York: Fordham University Press.

Griffiths, Tom. 2010. *The humanities and an environmentally sustainable Australia* (43) 2007 [cited 11 July 2010]. Available from <http://www.australianhumanitiesreview.org/archive/Issue-December-2007/EcoHumanities/EcoGriffiths.html>.

Harari, Josue, and David Bell. 1982. Introduction. In *Hermes: Literature, science, philosophy*, edited by M. Serres, J. Harari and D. Bell. Baltimore: Johns Hopkins University Press.

Haraway, Donna. 1991. *Simians, cyborgs, and women: The reinvention of nature*. London: Free Association.

Head, Lesley. 2007. Cultural ecology: The problematic human and the terms of engagement. *Progress in Human Geography* 31(6):837-846.

Head, Lesley, and Jennifer Atchison. 2009. Cultural ecology: Emerging human-plant geographies. *Progress in Human Geography* 33(2):236-245.

Heidegger, Martin. 1977. The question concerning technology. In *Martin Heidegger: Basic writings*, edited by D. Krell. New York: Harper & Row.

Hitchings, Russell. 2003. People, plants and performance: On actor network theory and the material pleasures of the private garden. *Social & Cultural Geography* 4(1):99-113.

Hitchings, Russell, and Verity Jones. 2004. Living with plants and the exploration of botanical encounter within human geographic research practice. *Ethics, Place & Environment* 7 (1 & 2):3-18.

- Klein, Julie Thompson. 1990. *Interdisciplinarity: History, theory, and practice*. Detroit: Wayne State University Press.
- Latour, Bruno. 1999. Circulating reference: Sampling the soil in the Amazon Forest. In *Pandora's hope: Essays on the reality of science studies*. Cambridge, MA: Harvard University Press.
- Leopold, Aldo. 1987. *A Sand County almanac and sketches here and there*. Oxford & New York: Oxford University Press.
- Martin, Gary, J. 1995. *Ethnobotany: A methods manual*. London: Chapman & Hall.
- Miller, David, and Peter Reill. 1996. *Visions of empire: Voyages, botany, and representations of nature*. Cambridge U.K. and New York: Cambridge University Press.
- Miller, Gordon. 2009. Preface. In *The metamorphosis of plants*, edited by G. L. Miller. Cambridge and London: The MIT Press.
- Moran, Joe. 2010. *Interdisciplinarity*. London and New York: Routledge.
- Nabhan, Gary. 1993. Foreword: Learning the language of fields and forests. In *Faith in a seed: The first publication of Thoreau's last manuscript*, edited by B. Dean. Washington, DC: Island Press.
- Nicolescu, Basarab. 2002. *Manifesto of transdisciplinarity*. Translated by K.-C. Voss. Albany: State University of New York Press.
- Prigogine, Ilya , and Isabelle Stengers. 1984. *Order out of chaos: Man's new dialogue with nature*. London: Shambhala.

- Repko, Allen F. 2008. *Interdisciplinary research: Process and theory*. Los Angeles and London: Sage.
- Rose, Deborah, and Libby Robin. 2010. *The ecological humanities in action: An invitation* (31-32) 2004 [cited 11 July 2010]. Available from <http://www.australianhumanitiesreview.org/archive/Issue-April-2004/rose.html>.
- Ryan, John. 2009. Plants that perform for you? Plants that perform for you? From floral aesthetics to floraesthesia in the Southwest of Western Australia. *Australian Humanities Review* 47: 117-140.
- Ryan, John. 2010. Towards a corporeal aesthetics of plants: Ethnographies of embodied appreciation along the wildflower trail. *Continuum* 24 (4): 543-557.
- Schiebinger, Londa. 2004. The private lives of plants. In *Nature's body: Gender in the making of modern science*. New Brunswick, NJ: Rutgers University Press.
- Seddon, George. 1972. *Sense of place: A response to an environment*. Perth, W.A.: University of Western Australia Press.
- . 2005. *The old country: Australian landscapes, plants and people*. Cambridge & New York: Cambridge University Press.
- Serres, Michel. 1982. *Hermes: Literature, science, philosophy*. Edited by J. V. H. D. F. Bell. Baltimore & London: The Johns Hopkins University Press.
- . 1995. *The natural contract*. Translated by E. MacArthur and W. Paulson. Ann Arbor: The University of Michigan Press.

- . 2002. The art of living: A conversation with Michel Serres. In *Hope: New philosophies for change*, edited by M. Zournazi. New York: Routledge.
- Serres, Michel , and Bruno Latour. 1995. *Conversations on science, culture, and time*. Translated by R. Lapidus. Ann Arbor, MI: University of Michigan.
- Snow, C.P. 1993. *The two cultures*. Cambridge: Cambridge University Press. Original edition, 1959.
- Soulé, Michael , and Daniel Press. 1998. What is environmental studies? *BioScience* 48 (5):397-405.
- The University of Utah. 2010. *Environmental humanities graduate program* 2009 [cited 11 July 2010]. Available from <http://www.hum.utah.edu/eh/>.
- Thoreau, Henry. 1993. *Faith in a seed: The dispersion of seeds and other late natural history writings*. Washington, DC: Island Press.
- . 2000. *Wild fruits: Thoreau's rediscovered last manuscript*. Edited by B. P. Dean. New York and London: W.W. Norton & Company.
- Tyrrell, Ian. 2005. placing george seddon. *Environmental History* 10 (4):752-754.
- Walls, Laura Dassow. 1995. *Seeing new worlds: Henry David Thoreau and nineteenth-century natural science*. Madison, WI: University of Wisconsin Press.
- Wilson, Edward O. 1998. *Consilience: The unity of knowledge*. New York: Alfred A. Knopf.
- Wordsworth, William. *The tables turned: An evening scene on the same subject* 1798. Available from <http://www.bartleby.com/145/ww134.html>.

