Begin with the Creek! A Leopoldian solution to the failure of the USDA's Conservation Reserve Program in Iowa

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Abstract

Leopold proved to be a seer of future landscapes. He absorbed firsthand the results of introduced agricultural practices to the valleys of the Southwest. He encountered river channels filled in by sediments from unaccustomed storm runoff due to intensive grazing. Trout streams were converted to piles of boulders. Streams are where life congregates through dusty stretches of dryland. The same is evident through more hydric lands extensively cropped for agriculture. The Iowa landscape is crisscrossed by green ribbons, as well, but vast fields of corn and soybeans make up the 'desert' through which they run. Commodity crop production relies on a simplified landscape and it is an up-and-down avocation relying on a favorable mix of weather, economics, and politics for success. Conservation has been an integral part of the institution with government stepping in when degraded conditions threaten rural livelihoods. The Soil Conservation Act of 1935 was the first incarnation of federal assistance and the conservation of soil, water, and wildlife continues with each iteration of the Farm Bill. The next round of Farm Bill negotiations commences in 2018 and it is, again, an opportunity to refine and enhance the conservation programs of the US Department of Agriculture (USDA). The USDA's Conservation Reserve Program (CRP) allocates $1.5 billion per year for conservation on working lands. A significant sum that should result in enduring results, but CRP conservation contracts of 10-15 years do not deliver the permanent change in land use needed to arrest soil erosion, improve water quality, and enhance wildlife habitat for an uncertain future. The benefits from these ecosystem services cease when contracts come due and land managers plow conservation acres back under for crop production. Similar results occur when the CRP enrollment cap is reached. The last two Farm Bills (2008 and 2014) have reduced the CRP enrollment cap from a high of 2002's 39.2 million acres to 24 million acres by FY2018. Fewer acres enrolled in the program puts a premium on the acres that remain. Leopold would implore us to "begin with the creek." This paper follows that advice and argues the use of a corridor conservation model, based on the existing stream network, to establish a Riparian Connectivity Network. The tools to do so are readily available in today's conservation programs, but a change of emphasis is needed to concentrate subsidies on the parts of Iowa's working lands that will achieve the greatest ecological return on our conservation investment.

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> *Begin with the creek: it will be unstraightened…The creek banks are wooded and ungrazed…Many things are expected of this creek and its woods: cordwood, posts, and sawlogs; flood control, fishing, and swimming; nuts, and wildflowers; fur and feather. (Leopold, 434)*

1. Introduction

Creeks and rivers are the circulatory system for the land "body". The cycling of water over continental expanses, back into the oceans, mimics the journey of blood to the heart. Life is possible wherever water runs and is sustained for as long as water remains. The health of these stream networks is symptomatic of the world through which they run. Our river systems have been made to absorb many indignities as human encroachment along every reach of every watershed converts natural communities into agriculture, urban development, and the transportation and utility systems connecting it all. The relationship between human connectedness and the connectedness of natural communities is an inverse. The continued development of the first diminishes linkages in the second. Pollution is introduced at every bend. If watercourses follow an eerily similar circulatory pattern, the vegetation that grows up along them perform much like the urinary system, filtering waste products, preventing toxic build-up in the vascular network. The presence of this transitional space between land and water is guarantor of the unique and essential goods and services accompanying these riparian ecosystems. "All riparian areas possess…ecological characteristics such as energy flow, nutrient cycling, water cycling, hydrologic function, and plant and animal population" (NRCS, 1996). The concentrations of life-sustaining ecological functions resident in riparian areas produce unique values relative to the surrounding uplands.

At the start of the twentieth century Aldo Leopold, as a newly minted forester out of Yale, worked for the burgeoning US Forest Service as a Ranger. Leopold proved a seer of future landscapes after he absorbed, firsthand, the lessons learned from recently introduced agricultural practices to the valleys of the Southwest. Time and again he encountered river channels, ancient life-sustaining systems in the desert, filled in by an accumulation of sediments dislodged by unaccustomed torrents from storm events because intensive grazing had cropped native grasses to the nub. The denuded terraces and slopes of the valleys were further impacted by the compacting movement of cattle and sheep herds and the density of their numbers. The erosive aftermath led to desolate waste. Much like Leopold's Sapello River from *Some Fundamentals of Conservation in the Southwest*, what were once beautiful willow-lined trout streams became piles of boulders (Leopold, 230).

Streams are where life congregates through dusty stretches of dryland; in the water and wherever riparian cover puts down roots on claustrophobic substrates pinched between canyon walls. The same is evident even through more hydric lands used extensively for cropping agriculture. The Iowa landscape is crisscrossed by green ribbons, as well. More obvious in the spring when crops are just getting started, they nonetheless interrupt the monotony of the state's uplands where far-reaching fields produce essential industrial inputs for state, national, and global economies.

Land is valuable in Iowa, because farming produces value. The Corn Belt region of the United States fetches an average of $6,290 per acre, as opposed to the ranching dominated Mountain region which averages $1,110 per acre. Iowa is tops in the Corn Belt with a per acre value of $7,850; Illinois, a close second, is $7,400 an acre (Land Values, 2016). Life, in the form of self-sustaining natural communities, must compete with value, the sustaining factor of today's socio-economic paradigm. At times, life trumps value along the twisting ribbons of Iowa's waterways where a diversity of wild species is conserved, but often this ecological space is truncated by the land use decisions of Iowa's farmers. The continuity of conservation depends on who owns the land.

Conservation on highly disturbed, privately owned land means sacrificing hard income for the more intangible benefits associated with ecosystem services. Cultivation practices have been altered in the past for conservation purposes through income support programs legislated by the federal government. The Soil Conservation Act of 1935, Public Law 74-46, was the first, a response to the Dust Bowl years (GPDAC, 1936). PL 74-46 bemoaned "the wastage of soil and moisture resources on farm, grazing, and forest lands" and declared it "a menace to the national welfare" (SCA, 1935). The program encouraged farmers to plant certain crops, or not at all, letting the land idle, stopping the soils from becoming airborne.

The Conservation Reserve Program (CRP), enacted by the Food Security Act of 1985, and administered by the United States Department of Agriculture (USDA), claims similar goals to restore converted landscapes to purposes other than agricultural output. Individual contracts guarantee annual rental payments to eligible landowners through the Commodity Credit Corporation (CCC), the financing arm of the USDA. "Under the CRP, the CCC will enter into contracts with eligible participants to convert eligible land to a conserving use during the contract period in return for financial and technical assistance" (CRP, 2003).

The CRP inventory largely consists of individual land parcels, under short-term retirement contracts, adopting conservation practices "to conserve and improve the soil, water, and wildlife resources of such land" (PL 99-198, 1985). Parcels enrolled in the CRP provide the infrastructure by which the three legislated ecosystem services are realized. Conservation of soil, water, and wildlife has extended across 36.8 million acres of US working lands at the height of CRP enrollment in 2007 (Stubbs, 2014), but that area has since declined to 23.9 million acres

(USDA-FSA, 2017). Each year conservation parcels come in and go out according to several factors and when they leave the program it is more often the case that they are put back into production, terminating the conservation practices applied during the retirement period (Secchi et al., 2008).

Aldo Leopold observed similar results in his time from a Civilian Conservation Corps program, “the offer was widely accepted, but the practices were widely forgotten when the five-year contract period was up” (Leopold, 175). Set-aside programs have always depended on the willingness of private land owners to relinquish economic advantage to improve ecological functioning. Conservation is carried out, for a time, but the impermanence of its application interrupts the multiple benefits that accrue when land is allowed to return to more natural states (Chase et al., 2016).

The absence of a universal conservation ethic among farmers in his day, led Leopold to concede that “there is a clear tendency in American conservation to relegate to government all necessary jobs that private landowners fail to perform” (Leopold, p. 179), even though he understood the task to be “too large, too complex, or too widely dispersed to be performed [well by] government” (Leopold, 180). These circumstances persist. The federal government pays farmers an offsetting amount to adopt conservation practices with CRP programs and in Iowa it has been a billion-dollar industry over the 30 odd years since enactment. The benefits from ecosystem services accumulate, but the caprice of politics and inherent uncertainty of economics changes the landscape, quite literally. The benefits of conservation dissipate when conservation practices are abandoned. In the state of Iowa, erosion of productive lands is still problematic, poor water quality is a daily concern, and stresses on wildlife persist. If government means to engage in conservation, committing taxpayer income to it, the investment should realize a return, producing the ecological capital necessary to pay back our withdrawals from the land "bank".

Nineteenth century US ambassador to Italy and landscape prognosticator George Perkins Marsh heralded the effects of derangement to the earth's surface from human action on the life which peoples it (Marsh, 4). Aldo Leopold dedicated a lifetime to undoing, through deeds and words, the damage done to land by the "unprecedented violence, rapidity, and scope [of our] invention of tools" (Leopold, 441). Rachel Carlson woke up an ambivalent giant by alerting citizens of the Unites States to the chemical contamination leaching into their daily lives. Hundreds and thousands of scientists continue the search for answers to complex biological relations, inching back the curtain, one study at a time, revealing the stage upon which we all take a turn. Plants, animals, soils, waters, and us. All of a piece. The time-worn truisms of Aldo Leopold hold to this day because his land ethic is a balanced exposition of human need versus the earth's ability to provide for it. This paper is not so much a presentation of research, as it is an appeal to the decision-making power concentrated in political, corporate, and landowner hands. We have not yet offset the abundance of our abuse with an appropriate effort at reconciliation.

The body of this analysis will demonstrate the efficacy of once again insulating Iowa's waterways with the indispensable flora needed to balance out the indecencies to which they have been subject. Conservation management of plant succession along US waterways can improve water quality, arrest soil erosion, and provide habitat for wildlife species (Bourgeois et al., 2016; Chase et al. 2016; Jones et al., 2015; Capon et al., 2013; Lemke et al., 2011; Lubowski et al., 2006; Thrupp, 2000), repaying long-past-due loans from the cached reserves of bygone plant communities. The CRP has allocated nearly 48 billion dollars to conservation over the life of the program (USDA-FSA, 2017), but the ephemerality of its implementation is more akin to making interest payments, instead of paying down the balance.

Working land conservation programs evolve with every iteration of the Farm Bill and the next period of political wrangling commences in 2018. The evolution towards a more enduring conservation legacy needs to continue with the 2018 negotiations. Current USDA program options provide the structure to extend a targeted conservation model. The conservation-targeting efforts through continuous CRP (CCRP), in combination with the more permanent land retirement mechanism of the Agricultural Conservation Easement Program (ACEP), already place environmentally sensitive portions of fields and pasture under more stringent stewardship expectations. Many of these segments are strategically sited along riparian corridors where edge-of-field buffers filter "sediment, particulate organics, and sediment-adsorbed contaminant loadings" from agricultural runoff (Helmers et al., 2008).

Elements of these CRP programs could help develop a corridor conservation approach. The "expansion of human land use has resulted in widespread loss and fragmentation of natural habitat. Corridors…are increasingly being adopted as a tool to maintain and restore biodiversity" (Hilty et al., 2006). The framework to apply such a tool is a Riparian Connectivity Network (RCN). The RCN is a conservation strategy concerned with connecting protected areas for biological conservation using riverine corridors (Fremier et al., 2015). In Iowa, rivers and streams, their channels and valleys, are often the only applicable areas left for protecting the state's wildlife legacy. Generalist species may roam over hill and dale, but the state's *species of greatest concern* are more than likely associated with an aquatic habitat for part, or all, of their lives (IWAP, 2015). The tools that improve habitat for wildlife also conserve soil and water. If the USDA must administer to the double-triple bottom line of conserving soil, water, and wildlife for people, planet, and profit, then *begin with the creek,* as Leopold implores.

2. The man with a plan: Rand Aldo Leopold

Leopold's writings on ecology reveal a complex of interconnectedness between a biotic league swarming over an abiotic mantle. He understood enough about the natural communities he interacted with daily to realize he grasped very little of the mighty matrix and this position advised caution in the treatment of wild things, or more expansively, the land. The opening quote declares a state of awkward equilibrium for conservation, not the optimum. It is an at-the-very-least where creatures of the woods and water are given respite from the daily gesticulations of humans managing the land. "The creek…will be unstraightened" is his appeal to farmers, in league with engineers, to abandon hubris when interacting with this one artifact of the land. The creek flows according to formulas too complex, and some still unknown, as to their nature, vexing prediction. "No efficiency engineer could blueprint the biotic organization of a single acre," says Leopold (460) and it will take the lifetimes of many capable scientists to understand the intricate biogeophysical underpinnings of a slowly meandering stream; best-guesses may have to suffice for actual knowledge.

Leopold applied his emerging understanding of natural communities to the restoration of a biologically bankrupt sand county farm. Friends, students, colleagues, and most importantly his family enabled Leopold to articulate his vision of "the land" in words and in the field, restoring the grounds around "the Shack" to a functioning ecological sanctuary for Wisconsin's disappearing flora and fauna. His wife Estella, daughters Nina and Estella, and sons Carl, Luna, and Starker accompanied him, their efforts helping Leopold to forge his ecological treatise.

In the spring of 1936 Aldo Leopold and family planted over 2,000 trees on that parcel of land. The weather that followed was, as of that year, one of the driest on record; summer presented no relief. Leopold recorded the tree mortality in his journal: 95% of Norway pines, dead; 99% of white pine, dead; all Mountain Ash, dead; only the Tamarack held ground at 50% mortality (Meine, 365). The outcome of this first tree planting was disappointing, but did not deter Leopold's enthusiasm for this restoration project. The state's natural systems had been broken when the great pineries of the north were felled and ham-fisted farming methods followed. The land absorbed much abuse throughout the initial wave of natural resource extraction, but Leopold was determined to heal one small part.

Leopold was not the first to sound the siren; advocates of all stripes, from Marsh to contemporary voices like restoration agriculturalist Mark Shepard, have criticized our persistent conversion of intact ecosystems for industrial output, but Leopold established a *land ethic*. A behavioral model that extends the same inalienable rights conferred upon humans to all members of the biotic community, to include the abiotic base upon which all living things subsist. "A thing is right only when it tends to preserve the integrity, stability, and beauty of the community, and the community includes the soil, waters, fauna, and flora, as well as people" (Leopold, 531).

It is not a purely altruistic notion. Leopold appreciated the harmony with ecological systems needed to guarantee human survival. The fate of land-health is our fate, as well. We cannot maintain the attitude of conqueror. Pretending to know what is valuable and what is worthless is a hazardous position to hold when "the biotic mechanism is so complex that its workings may never be fully understood" (Leopold, 173). The prospects for self-preservation are greater as trust, a reciprocating reliance, accrues in the community. As membership in the community grows, stability improves. Actions that deplete the community "decrease ecological resilience to disturbance or disruption. It produces ecosystems more vulnerable to ecological collapse and reduces the variety of viable alternative ecological organizations" (Peterson et al., 1998). Leopold spent decades contemplating this truth, "that a natural and sustainable reciprocity already regulated the hillside absent his management theory" (Shilling, 2009).

There is a necessity for natural resource manipulation by humans, but caution against abusing those resources from overuse. Land resources sustain human populations. That is the truth of the matter, but "we learn, in ecology at least, that all truths hold only within limits" (Leopold, 360). Leopold's writings presage a contemporary perspective on social-ecological interactions known as resilience thinking, or the persistence of relationships within a system and the ability to absorb changes of state and persist (Holling, 1973). Upsetting the natural balance of landscapes inhibits the resilience response to disturbance. So, if we are greedy, or too many, or inept in our manipulations of landscapes, the productivity of the land degrades to the point where it supports nothing of value. Leopold upholds the importance of landscape diversity "a food chain aimed to harmonize the wild and the tame in the joint interest of stability, productivity, and beauty" (Leopold, 462).

Modern agriculture tends towards simplicity and is a violent avocation. The successful practice of it necessarily requires the forceful expulsion of nearly all other living things from the arena; clean farming, as it was referred to in Leopold's day. Improvident as the practice of it often is, modern agriculture cannot be rejected outright. Too many depend on a few (increasingly fewer) to provide the sustenance for daily life. Leopold always accepted the necessity of reshuffling natural communities to suit the requirements of cultivation, but "the land should retain as much of its original membership as is compatible with human land-use. The land must of course be modified, but it should be modified as gently and as little as possible" (Leopold, 502). That is Leopold's rule of thumb: Take what is needed, but no more. Allow some space for the creatures that came before.

Unlike the settlement of the West where geological exceptionality was acknowledged, appreciated, and conserved as our nation's public lands, the exceptionality of the breadbasket is its incredible profundity. Seemingly every bit of arable ground has been turned over to farm, or fenced off for pasture. "Where cover and food [for wildlife] still occur together on fertile soils, they often represent negligence or delay, rather than design" (Leopold, 507). The consternation Leopold endured as witness to this ill-informed commitment is encapsulated in his response to an excerpt from The Weed Flora of Iowa, an early weed control manual:

> Manual - Peppermint (*Mentha piperita*). This plant is frequently found along brooks. The effectual means of killing it is to clear the ground of the root-stocks by digging.
>
> Leopold - One is moved to ask whether, in Iowa, nothing useless has the right to grow along brooks. Indeed, why not abolish the brook, which wastes many acres of otherwise useful farmland. (Leopold, 488)

The natural inclination of a farmer is to plow and plant, but the cumulative effect of these activities goes beyond individual property lines. Soil, herbicides, pesticides, and fertilizers travel with the wind and are flushed down streams, affecting others. When individuals fail to conduct themselves in a proper way government must step in.

Leopold kept his faith in the private landowner, the Jeffersonian yeoman farmer, but evidence of inappropriate land use was too consuming. "Erosion eats into our hills like a contagion, and floods bring down the loosened soil upon our valleys like a scourge (Leopold, 232). Government conservation policy on working lands has always supported individual choice by making farmer participation in conservation programs voluntary. The difficulty with this scheme is that decision-making processes are divided into a multitude of private landowners choosing sets of circumstances that maximize benefits, as realized through profit. "A system of conservation based solely on economic self-interest is hopelessly lopsided. It tends to ignore many elements in the land community that lack commercial value, but are essential to its healthy functioning" (Leopold, 180). The scale still tips towards deference to the private landowner. A complication that Leopold highlighted decades ago, though he realized that "when one addresses the subject of agriculture, one takes on a subject of immense proportions" (Meine, 1987).

As the human population grows the concomitant conversion of land to agricultural production means less area for the fulfillment of other ecosystem services. The facility of landscapes to counteract the negative effects of farming methods contracts as more acres are brought into production. Water and soil combine in sheet erosion over exposed land during storm events to carry productive soils away (Lubowski et al., 2006). Unused nitrogen and phosphorous from fertilizers and the remnants of herbicides and pesticides are carried along in the overland flow to adjacent waterbodies (Rundquist and Cox, 2014). Ag field drainage through subsurface tiling collects and deposits nutrient rich runoff into rivers and streams directly (Lemke et al., 2011).

"Conservation is a state of health in the land" (Leopold, 496). Undisturbed land retains that health, but escalating degrees of human modification imperil that salubrious state. The legacy of Aldo Leopold lives on the landscape. True to his word, he was one "humbly aware that with each stroke he [was] writing his signature on the face of [the] land" (Leopold, 63) and more than a contractual obligation on a piece of paper, Leopold's signature is written on the hills just outside Baraboo, Wisconsin. A pioneer of restoration Leopold reestablished the quality of self-renewal to a worn-out sand county farm. Leopold's ecological advocacy draws interest wherever a continuous crown of green shades a slow-moving stream, or whenever the call of a red-winged blackbird visits the ear.

3. The state: Iowa, the heartland of the breadbasket

The stockpile of realizations leading to a concerted conservation effort came late to the state of Iowa. By the time Yellowstone National Park was celebrating its eighth anniversary in 1880 Iowa was harvesting roughly the same acreage as it does today (Census of Agriculture, n.d.). The large fauna conserved within the bounds of Yellowstone also roamed the wild areas of a pre-settlement Iowa. Bison, elk, and the wolves that keep their numbers in check belonged to a great biotic community that once occupied the Iowa territory, stretching from the mighty Mississippi River to the muddy Missouri. George Perkins Marsh observes in his book *Man and Nature* that "nature, left undisturbed, so fashions her territory as to give it almost unchanging permanence of form, outline, and proportion" (Marsh, 29). European settlers came to the Iowa territory and disrupted this concordance by converting native biological communities to their productive use. Settlement began in the southeast corner of Iowa in the 1840s and reached the northwest corner by the 1860s (IWAP, 2015). Land surveyors impressed onto the land an unnatural checkerboard of straight lines and squares. Widespread cultivation between the lines followed, yielding dramatic changes to the land. The wilderness that was Iowa succumbed quickly to the plow.

In a virtual blink, Iowa's native habitats were converted from a biological crossroads consisting of tallgrass prairie and hardwood forests in the east; shortgrass prairie and prairie potholes in the north and west; maple, basswood, and pine forests in the northeast; and oak savannahs spreading over the south (IWAP, 2015), to the simplified fields we see today. Elements of these biomes were patchy or expansive on the landscape, but the cadastralization of Iowa's terrain pushed these natural communities of vegetation and wildlife into scattered pockets along field edges or into river valleys too steep for the safe operation of farm equipment.

Leopold would add that "our grandfathers…killed off the prairie fauna and drove the flora to a last refuge on railroad embankments and roadsides" (Leopold, 418). The soil beneath Iowa's Eden proved to be its greatest legacy and is the basis for the state's economy (Iowa Prairies, 2001), but as soon as the plow blade exposed bare soil to wind and rain the land's productive base began to sluff skyward and downstream.

Agriculture, including the services and manufacturing base that support it, is the economic lifeblood of Iowa. Iowa cultivates approximately 26 million acres to produce the states' top two commodities, corn and soybeans. These two cultivars cover some 75% of Iowa's 36 million acres (Crop and land use, n.d.). The complete operational land use for agricultural is 33.4 million acres, or 93% of the state's land area and includes crops, pasture, house lots, forest, and land in conservation reserve. To offset the near uniformity of private ownership represented by agricultural interests, 715,000 acres, or 2% of the state, is preserved through federal jurisdiction, with another 102,000 acres protected in state and local parks, preserves, and forests. Urban development covers the other 5% of Iowa's land at approximately 2 million acres (Crop and land use, n.d.).

Industrial applications of agriculture account for more acres of land converted to productive use than any other economic sector in Iowa. Efficiencies in farming are realized through the expulsion of all other competitors, but the massive conversion of biologically diverse natural areas to closely controlled monocultures comes with a price. "Indigenous vegetable and animal species are extirpated, and supplanted by others of foreign origin, spontaneous production is forbidden or restricted, and the face of the earth is either laid bare or covered with a new and reluctant growth of vegetable forms, and with alien tribes of animal life" (Marsh, 36). The "annual crop" cycle is the basis for modern commodity production and the annuals chosen for cultivation do not compete well against other vegetation types. To reap the maximum harvest of the preferred grains and legumes the land must be denuded before planting and sprayed for weedy volunteers during the length of the growing season (Shepard, 2013). The ecological impacts have been enormous. The Iowa Wildlife Action Plan (IWAP) acknowledges the pressures put on wildlife from game hunting, indiscriminate and accidental killing, and direct conflict from introduced species, but indirect stress from the conversion of natural plant communities to agricultural lands is still the greatest stress on Iowa's wildlife (IWAP, 2015).

The Conservation Reserve Program is one policy vehicle dedicated to restoring disturbed agricultural landscapes for services other than agricultural output. The application of the CRP is nationwide, but a representation of its results on working lands can be seen in the state of Iowa by reviewing the three targeted ecosystem services described by the language of the 1985 Farm Bill. United States Public Law 99-198, the Food Security Act of 1985, explicitly states that the program's purposes are "to conserve and improve the soil, water, and wildlife resources of such land and to address issues raised by State, regional, and national conservation initiatives" (PL 99-198, 1985).

The CRP has demonstrated a positive influence on soil erosion with a significant downward trend since its inception. Iowa's erosion rate in 1982, prior to the Farm Bill era, was 11 tons per acre. In 2012, that rate was six tons per acre (Natural Resources Inventory, 2012). But Leopold once characterized soil as "the fundamental resource, and its loss the most serious of losses" (Leopold, 250). The metric used to assess soil loss tolerance level is the T value. It is the maximum rate of annual soil loss that will permit indefinite crop productivity on a given soil (Natural Resources Inventory, 2007). The T value for Iowa is considered to be five tons per acre

(Cox et al., 2011). Each acre can experience soil loss up to five tons and still produce a commodity crop for a sufficient harvest.

Research has shown that soil formation occurs at a rate closer to 0.2 tons per acre (Logan, 1982). The difference between Iowa's annual erosion rate of six tons per acre and the T value of five tons per acre is a negative relationship without questioning the rationale behind the soil loss tolerance equation. Using Logan's research, it is understood that soil is sluffing off at a pace beyond the ability of modern farming, or nature, to compensate and sustain yields into the future. The state's waterways carry a 156,000,000-ton load of soil away from an area where only 5,200,000 tons of soil form each year.

The Environmental Working Group (EWG), a non-profit organization dedicated to protecting human health and the environment, questions the efficacy of the T value, in general, and Iowa's, specifically, in their 2011 report *Losing Ground*, finding soil loss from ephemeral gullies, created during heavy storm events, far exceeded soil loss modeling numbers generated by Iowa State University. "Gullies reappear rapidly where farmers have tilled and planted over natural depressions in the land and form "pipelines" that swiftly carry away the water the earth cannot absorb" (Cox, 2011). If the yardstick for erosion were to be calibrated using Leopold's land ethic, or the investigations by the Environmental Working Group, Iowa's soil loss is disastrous.

Soil erosion on working lands has been framed in a manner so as not to seem too alarming, but that is not the case for water quality, as it is viewed in Iowa. The agricultural applications that maximize Iowa's corn and soybean yields make the state's waterways unsafe for water contact recreation, aquatic life, and drinking water (Iowa DNR). For example, the Des Moines Water Works, the state capital's municipal water utility, sued three upstream counties, within the Raccoon and Des Moines River watersheds, in March 2015. The two rivers are the primary water sources for Des Moines metro. Source water quality had diminished such that the world's largest nitrate removal facility was constructed to denitrify the water to meet the Environmental Protection Agency's Maximum Contaminate Level for nitrate at 10 parts per million for human consumption. Sampling had showed nitrate levels at four times the standard. The denitrification process adds an extra four to seven thousand dollars to operating costs, per day (Stowe, 2015). Hence the decision to recover that extra expenditure through the legal system.

The Raccoon and Des Moines rivers are only two of the 608 category 5 waterbodies in the state of Iowa, meaning they do not meet Clean Water Act Section 303(d) requirements. Category 5 waterbodies are impaired and a Total Maximum Daily Load (TMDL) plan is required (Iowa 303(d), 2016). The TMDL is a process that identifies the sources for pollutants and provides reduction targets for contaminant loading to fully attain water quality standards. Monitoring is administered by the Iowa Department of Natural Resources to assess the status of *beneficial uses* for state waters. The number of impaired waters has increased in every reporting year (every other year) with an overall increase from 180 impaired waterbodies in 1998 to 2016's 608. Monitoring is always a limiting factor due to lack of funds, personnel, or time, but it can be expected that as monitoring increases, the number of waterbodies on Iowa's impaired list will also increase (Iowa 303(d), 2016).

A more pedestrian measure of Iowan's concern for the quality of their water can be found in the Des Moines Register's *Your 2₵'s Worth,* a daily tweet-sized editorial section where people often comment on the water problems plaguing the state and affecting them personally. Iowa's wildlife does not have the same access to media outlets as do officials and citizens, but they do have an interested public speaking on their behalf. The Iowa Environmental Council, Iowa Water Center, Conservation Districts of Iowa, Practical Farmers of Iowa, Trees Forever, Iowa Agriculture Water Alliance, Iowa Dept. of Agriculture and Land Stewardship, and the Iowa Department of Natural Resources are some of the environmentally concerned groups in Iowa attempting to moderate the market-impelled failings of modern industrial agriculture.

One of the key human-compiled documents used to assess, track, and advocate for Iowa's wildlife is the Iowa Wildlife Action Plan. The IWAP was initiated in 2003 in response to a Congressional funding mandate to receive State Wildlife Grants. The State Wildlife Grants Program provides federal grant funds for developing and implementing programs that benefit wildlife and their habitats, including species not hunted or fished, with priority placed on projects benefiting *species of greatest conservation need* (SGCN) (IWAP, 2015). The IWAP identified 313 SGCN in 2012, wildlife species suffering from extensive loss of habitat and experiencing continued stress from habitat degradation, with the number climbing to 405 SGCN in 2015 (IWAP, 2015). A significant increase over the previous census. An artifact of increased awareness and timely submission of research results, perhaps, but still an incontrovertible indication that habitat conditions are still declining in Iowa, and the IWAP reveals this regression to be across all taxa.

4. The program: Today's Conservation Reserve Program

On agricultural working lands production of commodity crops is considered the highest most valuable use. The once boundless biota has been plowed under over millions of acres throughout the United States to advance industrial scale cultivation, but nowhere as expansively as in America's Heartland. The "pristine" "American" wilderness stood in opposition to the European ideal of land and was not conducive to productive use. Clearing of the land's original members and drainage of areas too wet to plow followed the Anglo-European imposition of exclusive land-use rights. Parts previously managed through more permissive stewardship standards by resident North American cultures succumbed to this wave of expropriation (Mann, 13).

The Iowa Department of Natural Resources (IDNR) declares that human modifications to the landscape and to rivers have altered waterways, contributing to Iowa's environmental problems such as stream bank erosion, habitat loss, flooding, and reduced water quality. The IDNR is counteracting these consequences with river restorations designed to overcome the effects of waterway alterations and improve their function and value. Dam removal and mitigation, bank stabilization, and riparian buffer installations increase fish populations, benefit wildlife, reduce flood damage, protect agricultural land, increase recreational opportunities by making rivers safer and more enjoyable, and benefit the economies of nearby communities (IDNR, n.d.).

The Iowa program is an important response to the "destructive agency of man" (Marsh, 40), but it is relatively new, with indefinite funding, and is actively developing the tools needed to mitigate stream impacts and restore structure. The federal government has been responding to agriculturally induced resource degradation for decades and continues so with the Conservation

Reserve Program, and other conservation initiatives, administered by the USDA's Farm Service Agency (FSA). The long-term goal of the program is to re-establish valuable land cover to improve water quality, prevent soil erosion, and reduce loss of wildlife habitat.

Implementation of this conservation scheme depends entirely on voluntary enrollment of eligible acres by private landowners. Landowners enter into contracts with the federal government to idle their land from commodity crop production for a time varying between 5 and 50 years, depending on the specific program, though most contracts run for a period of ten to fifteen years. The rental rate for set-aside cropland is determined by its productivity, a value that closely corresponds to the Corn Suitability Rating (CSR), a measure of the land's capacity to produce a commodity crop (Corn Suitability Rating, 2013). Farmers must adhere to the conservation practices identified in a Conservation Plan developed by the farmer, with the help of FSA agents, and approved by the CCC to receive payment.

Total nationwide expenditure for CRP rental payments from 1986 – 2016 was $47,910,642,235; in the state of Iowa $5,534,050,447 was spent over the same period. Second on the list is Texas at $4,083,083,104. Total acres per state in the program change every year, but a comparison of Iowa and Texas from 2016 reveals the value of Iowa's conservation acres: Texas received $110,007,748/2,990,159 ac, or $37/acre in 2016; Iowa received $318,308,818/1,689,141 ac, or $188/acre for that year (USDA-FSA, 2017). The difference between the value of Iowa's conservation acres and those in Texas is directly related to the CSR. Iowa soils are exceedingly productive, and the state's farmers get paid the greatest per acre average for adopting conservation practices.

CRP enrollment periods are decided by the Secretary of Agriculture who declares an open season when eligible offers from farmers will be accepted. The last sign-up was held from

Dec. 1, 2015 to Feb. 26, 2016. It was the 49th CRP open enrollment period since enactment in 1985. This periodic enrollment window is a 'general sign-up' and has been the vehicle by which most CRP acres are enrolled. During open enrollment landowners submit eligible parcels that must compete against other offers evaluated with an Environmental Benefits Index (EBI). The EBI considers wildlife habitat benefits, water quality benefits, on-farm soil-retention benefits, benefits that will likely endure beyond the contract period, air quality benefits, and cost (CRP Assessment, 2008). Top scores receive contracts based on the submitted Conservation Plan until that open period's acreage quota is filled. Many offers are not awarded contracts. In Iowa, 63,391 acres were offered during the 49th general sign-up, but only 9,725 acres were brought into the CRP, a 15% rate (McConnell, 2016).

The USDA conservation practice (CP) portfolio includes dozens of restorative actions used to improve the three ecosystem services emphasized. They are referred as CP-1…CP-23A…CP-42, etc. (CRP Practices Library). CRP general sign-up acres are predominantly sewn in CP-1, Introduced Grass and Legume Establishment; CP-2, Native Grass, Forb, and Legume Establishment; or CP-10, Vegetative Cover – Grass – Already Established (EWG Conservation Database, 2014). Other conservation initiatives such as Bottomland Hardwoods, Floodplain Wetland, Pollinator Habitat, or State Acres for Wildlife Enhancement (SAFE) adopt more impactful CPs, concentrating funds on more environmentally sensitive lands and enhancing the per acre value of the CP. The potency of the CP adopted factors into farmer compensation. Payout for the general sign-up averages $51 an acre, but other programs can more than double that amount. Farmable wetlands fetch $115/acre, the Conservation Reserve Enhancement Program, in coordination with state conservation goals and assistance, can average $140/acre, and continuous CRP, a counterpart to general sign-up, brings $102/acre (NSAC's Blog, 2015).

Continuous CRP (CCRP) illustrates the evolution USDA conservation programming has experienced since inception. The program began in 1985 with CRP, but also Conservation Compliance, 'Sodbuster', and 'Swampbuster'; three provisions used to influence land use by eliminating federal farm program benefits for not adopting soil conservation techniques on Highly Erodible Land (HEL), or for bringing more HEL or wetlands into cultivation (Claasen, 2004). Conservation innovations and consolidations accompany most Farm Bill negotiations "to address issues raised by State, regional, and national conservation initiatives" (PL 99-198, 1985). CCRP was part of the Federal Agriculture Improvement and Reform Act of 1996, or Farm Bill '96, and it focuses on critical areas for certain high-priority conservation practices eligible for enrollment in CRP, but on a continuous and non-competitive basis. CP-22, riparian buffers; CP-21, grass filter strips; and CP-8, grassed waterways are high-priority conservation practices that make up a majority of CCRP acres (Clark and Reeder, 2005).

Highly Erodible Land (HEL) has been a foil for agriculture, though it still gets planted, and soil conservation was the primary rationale for the 1985 Farm Bill, extending the historic battle against soil erosion taken up by the Soil Conservation Act of 1935. Conservation practices were mandated on farmland with an Erodibility Index (EI) of 8, or higher. The EI is closely associated with the soil loss tolerance (T) value and describes the potential of a soil to erode; higher numbers mean increasing potential. Prior to the 1985 Farm Bill, the soil erosion rate for the US was 7 tons per acre from both wind and water erosion; in 2012 that rate was 4.6 tons per acre (USDA, 2015). The decrease can be directly attributed to the USDA's conservation programs, primarily the CRP, focused on retiring HEL from cultivation (Claasen, 2004).

The CRP has made immense contributions to the field of conservation by enlisting private landowners. The ethic it has re-introduced into land management has percolated into the sensibilities of many farming communities (Doudna, 2015). Farming is a volatile occupation, but a measure of certitude can be applied to the characteristic variability by entering into a CRP contract disbursing annual rental payments. The adopted practices also help to alleviate some of the negative externalities that come with commodity crop production, in turn, bolstering the natural communities holding on at the margins. The CRP emulates Leopold's foresight, but its record of success can be as spotty as the first few tree plantings at the Shack.

The CRP inventory is reactive to politics and economics and enrollment is elastic, fluctuating according to policy wrangling and commodity markets (Lubowski et al., 2010). CRP funding is re-negotiated every five, or so, years with reauthorization of the omnibus Farm Bill legislation. The last two Farm Bills, 2008 and 2014, have reduced the CRP enrollment cap by 16 million acres from a high of 39.2 million acres in 2002 to a maximum enrollment of 24 million acres by FY2018. A diminishing acreage cap limits the number of offers accepted during general sign-up and diminishes the likelihood that old contracts will be extended (Stubbs, 2014). EBI ranking will still prioritize the best offers for conservation maximization, but conservation acreage will decline.

Locally there are victories. A plant community in a riparian buffer, set aside over multiple CRP contracts, allowed to succeed, but others will be plowed under, again. Like a big game of Press Your Luck, the whammy can land anywhere, resetting the accumulated conservation benefits to zero. Divestment is not isolated to the biological bank; billions of dollars in annual rental payments have been invested by taxpayers to secure important environmental benefits through short term land retirement. The value of this investment is quickly eroded if large amounts of environmentally sensitive land are brought back into production (CRP Assessment, 2008).

The Energy Independence and Security Act of 2007, coupled with a historic Midwest drought in the early 2010s, established an economically compelling reason for farmers to plow CRP parcels back under to take advantage of record per bushel corn prices. Secchi et al. (2009) observe that environmental impacts increase drastically when high corn prices make even marginal, more environmentally fragile land, economically productive. It has been shown that acres of low agricultural quality are more likely to move in and out of intensive cultivation and are also more environmentally sensitive based on indicators for erosion, nutrient loss to water, and proximity to imperiled species (Lubowski et al., 2006). High crop prices and political pressure, as Rhul et al. (2007) declare, can accelerate potentially irreversible environmental degradation, establishing "the need for developing more effective targeted conservation policies." The inherent volatility of agricultural commodity pricing has been the concern of Farm Bills since the first, but even the leveling effect of government income support programs cannot compensate for the irregularity of agricultural supply and demand. There will be good years and there will be bad years and the impacts to natural communities will be subject to that vacillation.

Further exacerbating an eroding inventory of CRP parcels is the disjunct nature of their placement on the landscape, spatially and temporally. Chunks of conservation land, erratically spaced, operate no differently than the original fragments left after the isolating effects of development. "Human-induced fragmentation…permanently affect[s] biodiversity. Fewer, smaller, and more isolated habitat patches with increased edge effects can lead to species loss and changes in community composition" (Hilty et al., 2006). The CRP general sign-up is the primary approach to aiding individual farms, but conservation practices are dispersed across the landscape; an approach that helps address resource concerns on individual farms, but does not ensure that collective resource issues are being resolved (Perez and Walker, 2014).

Continuity through time is a consideration of the EBI, but contiguity to other parcels, or reserves, is not, and connectivity through a landscape is not factored. Even though there is a strong rationale and broad support for landscape approaches in the conservation literature, many conservation activities continue to proceed in a piecemeal fashion because of the way conservation programs and institutions have been established over time (NASEM, 2016). Contractual limitations of conservation enrollment threaten the conservation portfolios of Corn Belt states at a time when continuity of natural communities on the landscape is understood to be essential to the survival of many species of greatest conservation need (IWAP, 2015). The EBI could and should be improved to include factors that address whether an offered parcel relates to other public or private lands already protected (CRP Assessment, 2008), and the weight of this consideration should appreciate as a function of its proximity to riparian areas.

5. The science to support

As this is an appeal and not a research project, there is nothing cumulative to any particular scientific discipline, but science is, nonetheless, the body of work which informs the policy-making process. A preponderance of evidence details the critical structure of riparian systems and their contributions to healthy ecosystem functioning. Capon et al. (2013) justify riparian ecosystems as 'hotspots' for climate change adaptation and support their hypotheses with a considerable background for *Riparian Ecosystems in the 21st Century: Hotspots for Climate Change Adaptation?* Khoury et al. (2011) do the same while delivering *A Freshwater Conservation Assessment of the Upper Mississippi River Basin Using a Coarse- and Fine-filter Approach*. Their dual approach demonstrates a worthwhile investment in developing a basin-wide context to achieve sustainable biodiversity conservation in rivers. May (2006) introduces the use of visual and conceptual connectivity to rivers to harness human creative energy in ameliorating ecosystem integrity with *"Connectivity" in Urban Rivers: Conflict and Convergence Between Ecology and Design*. Natural science and social science contribute to our understanding of a human-run world and both champion the importance of river systems to the survival, and satisfaction, of the human species. Though no science is being created, here, the work of others helps point the way to a solution.

Working from an accumulation of research on the structure and function of the country's waterways, the Environmental Protection Agency (EPA) and Army Corps of Engineers (USACE) sought to clarify decades old confusion with the definition of *waters of the United States* (WOTUS). A Clean Water Rule was drafted to strengthen the Clean Water Act's (CWA) capacity to regulate pollution, degradation, and destruction of America's waterways:

> To provide that protection, the Supreme Court has consistently agreed that the geographic scope of the CWA reaches beyond waters that are navigable in fact. Peer-reviewed science and practical experience demonstrate that upstream waters, including headwaters and wetlands, significantly affect the chemical, physical, and biological integrity of downstream waters by playing a crucial role in controlling sediment, filtering pollutants, reducing flooding, providing habitat for fish and other aquatic wildlife, and many other vital chemical, physical, and biological processes. (Clean Water Rule, 2015)

The ruling updated CWA jurisdiction in accordance with previous Supreme Court opinions establishing the concept of "significant nexus," the relation of a US water to "downstream traditional navigable waters such that the water is important to protecting the chemical, physical, or biological integrity of the navigable water" (Clean Water Rule, 2015). The enhanced jurisdictional reach of the CWA, had it been implemented, would have covered thousands of miles of streams and millions of acres of wetlands across the country (NRDC, 2015), opening these waters to the EPA's permitting process.

From the perspective of this paper the Clean Water Rule is an essential policy initiative acknowledging the substantive position our water resources bear for the existence and identity of this nation, but it was prepared under the Obama administration. It is now under further review by the Trump administration. Presidential Executive Order No. 13778 (2017), issued by Donald J. Trump, seeks "to ensure that the Nation's navigable waters are kept free from pollution, while at the same time promoting economic growth, minimizing regulatory uncertainty, and showing due regard for the roles of the Congress and the States under the Constitution." This added review process is indicative of the way competing interests, working far up the food chain, influence the fate of natural communities living at the ineffectual end of the decision process.

The abrupt turn on this consequential and controversial policy demonstrates the vicissitudes of politics. The concerns of one political party disrupt the agenda of the other. Land managers, backed by agribusiness creditors, took exception to the Clean Water Rule because it was viewed as a 'land grab' by the federal government (Darwall, 2016), yet pro-environment policy centers like Environment Michigan note that "big agribusiness interests are among the largest roadblocks to cleaner water for the American people" (Madsen, 2011). It is tough to know who to trust. Private property rights must be balanced against the health of community resources, but declarations of fantastic abuse are declared by both sides to tip the lever of public perception in their direction. Herein lies the necessity for Leopold. As straight a shooter as there ever was, just ask the thousands of birds that filled his game pouch, his research sample set was the plants, animals, soils, waters, and us. A comprehensive examination of how all exist together. His premise "to live in real harmony with such a country" led him to conclude that it "seems to require either a degree of public regulation we will not tolerate, or a degree of private enlightenment we do not possess" (Leopold, 324).

Minnesota has initiated regulatory authority over the state's waterways with a shoreland management program requiring a 50-foot average width, 30-foot minimum, continuous vegetative buffer between working lands and public waterways. The buffer is an area of perennial vegetation, excluding invasive plants and noxious weeds, adjacent to all bodies of water protecting water resources from runoff pollution; stabilizing soils, shores, and banks; and providing for riparian corridors (MBWSR, 2017). It is a recognition that beyond the lip of the streambank land managers make land use decisions affecting the "chemical, physical, or biological integrity" of the waterways flowing through their properties and the restorative significance of riparian vegetation is too important to succumb to the variable treatment from individual land management choices.

The Environmental Working Group assessed the presence of Minnesota shoreland management buffers, after implementation, in *Broken Streambanks: Failure to maintain* *"buffer" zones worsens farm pollution* (Rundquist and Cox, 2014). They studied 37 counties in the intensively cultivated southern part of the state and found 45% of the total required acres of riparian buffer missing from small perennial streams, 27% gone from medium waterways, and a 28% deficiency along large rivers and streams. The report highlights the discrepancy between policy aspiration and private application. Even with the force of law waterways are still encroached on to maximize the productive area, but, to be fair, the policy was at an early stage and subsequent amendments have helped clarify the regulatory language, aiding compliance (MBWSR, 2017).

A similar study was conducted just south of Minnesota in *Iowa's Low Hanging Fruit: Stream Buffer Rule = Cleaner Water, Little Cost* (Rundquist et al., 2015). Iowa does not require any standard of buffer along waterways winding through working lands, but EWG illustrates the relative ease by which land managers could incorporate the mitigating properties realized from riparian buffer vegetation. The group evaluated waterways in five Iowa counties using year to year high resolution aerial photography to compare presence of and width of buffers along waterways. The report posits a 35-ft., 50-ft., and 75-ft. buffer standard width between fields and streams and calculates acres needed to fulfill each buffer standard for the streams assessed.

At the 35-ft. standard, 565 acres of corn and soy would need to be converted to satisfy the EWG buffer proposal in the five counties; 1,430 acres at 50 ft. and 3,522 acres at 75 ft. The five-county total area planted in corn and soy is 1,218,028 acres. The percentage of land given over to newly installed buffer would be .05%, .12%, and .29%, respectively (Rundquist et al., 2015). Doing so could help Iowa realize phosphorous and nitrogen reduction goals outlined in the Iowa Nutrient Reduction Strategy (INRS) (2016). The EWG report estimates this reduction to be 18% for phosphorous and 7% for nitrogen runoff with a 35-ft. standard. Helmers et al. (2008) would add that "to maximize infiltration of runoff, wider buffers or a greater buffer area to source area ratio should be used."

The INRS is a response to the challenge set forth by the 2008 Gulf Hypoxia Action Plan. Nutrient loading from agricultural runoff accumulates south of the Mississippi River delta promoting summer algal blooms in the Gulf of Mexico. The prolific explosion of algae is followed by mass die-offs and after sinking to the bottom bacterial decomposition of the algal bodies ensues, consuming oxygen in the process and depleting the ratio of dissolved oxygen in lower water levels of the Gulf, a process known as eutrophication (Gulf Hypoxia Action Plan, 2008). Oyster bed closures, fish kills, and threats to endangered species prompted Congress to establish the Inter-Agency Task Force on Harmful Algal Blooms and Hypoxia in 1998. The investigations of that group led to the 2001 Gulf Hypoxia Action Plan. The ultimate goal was to reduce the five-year running average of the hypoxic zone areal extent to less than 5,000 square kilometers by 2015 (Gulf Hypoxia Action Plan, 2001). The hypoxic zone measured 16,700 square kilometers in 2015 (Rabalais and Turner, 2015). The two Action Plans, 2001 and 2008, did not lead to the reduction, nor mitigation, nor control of hypoxia in the Gulf, in accordance with stated goals, but the 2008 Action Plan did result in the development of state nutrient reduction plans, as referenced by EWG above. In conjunction with the INRS, states in the Mississippi River Basin have produced plans to reduce the nitrogen and phosphorous loads from participating states by 45% before 2035 (INRS, 2016).

Iowa is not alone in its failure to restore land health. The Gulf hypoxic zone is a yearly reminder that the entire Mississippi River stream network flows through compromised lands. A resolution to this discord can be found in Corridor Ecology: The Science and Practice of Linking Landscapes for Biodiversity Conservation (Hilty et al., 2006), a conservation model readily applied to settings of pervasive human disturbance when aligned with a river system. The authors contend that riparian corridors are one of the most important landscape elements for biodiversity, because sometimes the vegetation growing alongside creeks and rivers is retained in human-dominated landscapes (Hilty et al., 2006). On an extensively converted landscape like Iowa's, rivers are often the only landscape element relevant for developing a conservation portfolio. And on a planet with temperature and precipitation fluctuations expected to aggravate already degraded lands (Capon, 2013), corridors represent avenues through which species might find suitable reserves (Beier and Brost, 2010), or, in highly disturbed states like Iowa, riparian corridors may survive as the only practical arenas for a diversity of biological activity.

If the tools used to conserve soil and water also improve habitat for wildlife (Jones et al., 2015), then a tool to conserve biodiversity can also improve soil and water. Conserving and restoring vegetation along river channels, in accordance with corridor ecology, may be a more resilient method for establishing a conservation network as the CRP inventory of contracted parcels decline in number and acreage. The existing parcel network of relatively small, geographically isolated, somewhat intact, natural-ish communities are undeniably vital to local wildlife populations, but in the wider context of building a more dynamic reserve system, riparian corridors offer greater structural complexity. Gravity's pervasive pull on water draws it overland down along an elevational gradient, across a latitudinal gradient, and through a gradient of precipitation, while also cutting its way through local geography, exposing and compiling the artifacts of geology into novel formations suitable for a great variety of species communities (Lawler et al., 2015). River valleys in Iowa exhibit the greatest variety of species, by default, as the homogeneity of cultivated fields push to the very edges of streambanks.

6. A solution

The Conservation Reserve Program's general sign-up is a relic. Conservation should not just disappear off the landscape. Conservation is more than just an envelope of time and extent delivered "during the contract period" by participating land users. Leopold's conservation, informed by his land ethic, accepts the rule of utility in land use, but also remember that "when land does well for its owner, and the owner does well by [their] land; when both end up better by reason of their partnership, we have conservation" (Leopold, 425). The land supports a complex community performing an infinite number of finite tasks, replenishing the life-sustaining mechanism inherent in land. Each acre supports the next and all are connected by water; intertwining surface waters, permanent and ephemeral, and slowly seeping groundwater. Riparian edges contain the convergence of the two providing for significant area in the "zone of contribution" to groundwater recharge, which, in turn, contributes to the baseflow needed to maintain stream life (Cohen, 2014). The Clean Water Rule acknowledges the influence smaller streams and headwaters have on the chemical, physical, and biological integrity of downstream waters (Clean Water Rule, 2015), but much of that volume comes off the landscape as storm runoff, or as infiltration through groundwater flow paths (Helmers et al., 2008). Ignoring, or being ignorant of, this connection has brought us here, to this pale attempt at reconciliation.

Straightening a stream is the ultimate indignity; us telling the land how its water should run. The nerve. Leopold starts with the creek, because it is the heart. It is the pulsating rhythm of the land body, reverberating amidst the millennia. Time is embedded in its banks and it tells its story "to those who know the speech of hills and rivers…". Leopold was born in Burlington, an Iowa city built on the bluffs of the Mississippi River. He noted the cyclical nature of the mighty river and later linked the erosive effects of agriculture to the Mississippi flood problem

(Leopold, 364). To finish the thought, and his quote from above, "…straightening a stream is like shipping vagrants – a very successful method of passing trouble from one place to the next. It solves nothing in any collective sense" (Leopold, 367). Trouble follows when stewardship gets backseated by landowners and land users in pursuit of clean farming, i.e., maximizing income by extending cropping fields to their utmost boundaries. When land is deprived of its original community only the artificial inputs of human industry allow anything to grow. Without the vigilant watch of its bygone members, wind and water pilfer the land, stealing its soil and whatever delinquent detritus remains. Cropland expansion and agricultural intensification supplant the vital ecosystem services that stabilize soil, filter water, provide flood control, sequester carbon, and enhance wildlife habitat (Secchi et al., 2008).

Stewards exist. I have seen them, or rather their signature. I have flown into the Eastern Iowa Airport, near Cedar Rapids, from the West and that flight path follows a stream wonderfully ensconced in green. The installation of filter strips, riparian forest buffers, and riparian herbaceous cover intermingle with prairie and forest remnants, a snaking mosaic of Midwest fertility. I have seen such sites in pictures, sumptuous aerials of Riparian Management Systems enveloping Bear Creek on the Risdal farm. But we are beyond demonstrating the practicality of conservation buffers. The USDA's National Demonstration Area at Bear Creek in Story County, Iowa works. It has demonstrated an ability to filter on-field applications from runoff. It has demonstrated a capacity for arresting soil erosion. It has demonstrated its worth as wildlife habitat. And these achievements are repeated and persist, time and again, in thousands of edge-of-field buffers, installed or original, via CRP or through prudent land management.

It is time to enhance the complementarities between agriculture and biodiversity. To this end, the periodic CRP general sign-up should be retired in favor of its more elastic counterpart, the continuous Conservation Reserve Program. Options for conservation reserve have been improved through subsequent Farm Bills, but the CCRP has proven the most popular and is effective at enrolling small parcels devoted to high-value conservation practices, providing significant positive environmental impacts over much larger areas (CRP Assessment, 2008). Instead of waiting for a general sign-up open season, producers can enroll land anytime in the on-going CCRP, as long as the added acres do not exceed the congressionally determined acreage cap (24 million acres).

A program realignment, such as this, need not supplant other ancillary CRP programs such as the Conservation Reserve Enhancement Program (CREP), or the Agricultural Conservation Easement Program (ACEP), programs that also target environmentally critical areas. The exchange of acreage would be confined to lapsing whole field contracts enrolled in general sign-up moving into the targeted conservation practices advanced by CCRP. The Environmental Benefits Index could still be a valuable tool for valuing parcels, but it should also consider a parcel's place on the landscape; is it contiguous to other reserve areas and does it augment connectivity between reserves. Fremier et al, (2015) suggest coordinating with existing private conservation easements already spatially biased toward riparian areas to amplify progress towards a coherent conservation network; a Riparian Connectivity Network (RCN). Given the lack of natural areas remaining in Iowa, a shift in CRP enrollment strategy can concentrate restoration efforts by prioritizing habitat protection, enlarging habitat complexes, reducing fragmentation, and increasing connectivity between larger areas of habitat (IWAP, 2015).

The premise of the Conservation Reserve Program is sound. The ecosystem services derived from its application improve soil, water, and wildlife, but the erratic distribution of most conservation parcels and their limited time on the landscape restrict the scope of their benefits. I have argued that, in Iowa, the current administration of federal conservation programs is failing to guarantee the mandates of the 1985 Farm Bill.

Caprice can be turned to permanence if the CRP's geographic focus turns from highly erodible land to riparian corridors. Amplifying the easement mechanism from the Agricultural Conservation Easement Program and coupling it with the conservation-targeting efforts of the CCRP would generate a system of edge-of-field buffers with staying power. The restoration of converted working lands takes time, but a conservation legacy is built by time.

> Conversion of agricultural land to maximize biodiversity requires numerous ecological changes, succession, and time for colonization. As a consequence, in the short-term, welfare declines as agricultural production declines, but the biodiversity benefits are not yet realized. Only after a potentially considerable time lag do biodiversity and its associated ecosystem services recover, allowing higher welfare to be achieved than at the start. (Cavendar-Bares et al., 2015)

Conserving and restoring corridors in the form of rivers and streams, stitching together a Riparian Connectivity Network, would be an efficient model for rerouting billions of federal dollars allocated to conservation programs. The river network is already a communal good with federal jurisdiction established by the Clean Water Act. The extension of *waters of the US* by the Clean Water Rule proved controversial because it expanded the influence of federal regulation and was perceived as further intrusion on private land rights, but *waters of the US* can still be a foundation for designing a system of conservation. Fremier et al. (2015) use riverine corridors as the backbone for their RCN. Targeted conservation based on 35, 50, 75, or even 100-foot riparian buffers would benefit all manner of conservation goals (Rundquist et al., 2015), while at the same time absorbing much of the excess nutrient loads from farm field applications.

The RCN is an emerging property of the existing stream network and the application of federal conservation programming can provide the resources needed to once again insulate this network with the vegetative base that allows natural communities to thrive. Leopold consistently emphasizes community and if a diverse cover is a superior cover for increasing a parcel's wildlife benefits, then encouraging its installation by subsidizing a larger fraction of its cost may prove cost effective (Hellerstein, 2010). "When a farmer owns a rarity, [they] should feel some obligation as its custodian, and a community should feel some obligation to help [them] carry the economic cost of custodianship" (Leopold, p 529).

Continuous CRP is a pricier program by two times compared to general sign-up, but it is a superior program to general sign-up for targeted conservation (CRP Assessment, 2008). The CCRP began with the creek by promoting edge-of-field conservation practices along riparian corridors. As Fremier et al. (2015) suggest, the seeds for an RCN are already in place, but the network is not complete. Riparian buffers, grassed waterways, and grass filter strips installed via CCRP increase the connectivity of the riparian network and riparian networks increase the resilience of landscapes through enhanced connectivity (Fremier et al., 2015). Adopting a corridor conservation model, like the RCN, to administer the Conservation Reserve Program is a Leopoldian solution grounded in the persistence of natural communities on working lands, generating ecosystem services, conveying ecological benefits far into the future.

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