Case Profile Series on
Land Trusts as Climate Change Solution Providers

Site Wind Right:
The Emergence of Proactive Planning for Low-Impact Wind Power Sites in the U.S. Wind Belt

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INTERNATIONAL LAND CONSERVATION NETWORK

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Cover: "Wild Blue Yonder," a photograph of the Flint Hills in Kansas, courtesy of photographer Brad Mangas, https://bradmangas.com. Thanks to Sandy Carlson at the Symphony in the Flint Hills for her generous spirit, and for making the connection to Brad. For more on the Symphony in the Flint Hills, see https://symphonyintheflinthills.org/about-the-flint-hills/ .

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CASE OVERVIEW FOR EDUCATORS

Topic: Wind Energy Facility Siting

Subtopics: Biodiversity Conservation, Geographic Information Systems (GIS), The Nature Conservancy

Timeframe: 2000 to 2021

Primary Learning Goals: (1) Better understand the complexity and persistence necessary to develop a useful GIS-based tool that helps balance development and conservation goals. (2) Move through project development analysis that considers, in sequence, situation, challenge, proposed solutions, implementation, and results.

Secondary Learning Goals: (1) Better understand the complex interrelationships and inter-dependencies of public, private, civic and academic sector actors in the energy facility development process. (2) Gain basic appreciation of what analysis GIS tools can facilitate.

Primary Audiences: (1) Land Conservation practitioners around the world, (2) Energy project developers, (3) Public decision-makers and regulators, (4) Staff, directors and supporters of NGOs, community organizations, (4) climate change analysts and advocates, and (5) interested members of the general public.

Prerequisite knowledge: General knowledge regarding climate change, renewable energy, and the conservation of land and biodiversity.

Summary: This case focuses on the development of a GIS-based tool called Sight Wind Right developed by The Nature Conservancy at the state and regional level, with implications for national and international renewable energy siting policy and practice. The tool assists energy project developers, corporate and individual consumers, legislators and regulators, and other interested parties better understand where to best site new wind energy facilities and avoid conflicts with biodiversity habitat, principally in central United States. The development of the tool itself, and the assemblage of the scientific knowledge required to make the tool useful, has taken about two decades and is still ongoing. Its deployment in the United States requires patience, persistence and passion for biodiversity conservation and the emergence of a wind energy industry at a national scale. The tools, which has had positive initial response, is being adapted for use in many locations around the globe, from Asia to South America.

TABLE OF CONTENTS

The Brazos Wind Farm, Texas, also known as the Green Mountain Wind Farm, Fluvanna, TX, 2004. Available from Wikipedia, https://en.wikipedia.org/wiki/Brazos_Wind_Farm

This case study is dedicated to two people who care deeply about remaining fragments of the Tallgrass Prairie, and who have helped make the Flint Hills of Kansas a place of spirit, purpose and poetry:

- Ken Baum, a founding trustee of the Kansas Chapter of The Nature Conservancy, and an exemplary steward of both TNC and his privately protected Walnut Ridge property in Stilwell, Kansas, and;

- Jim Hoy, professor emeritus of English at Emporia State University, whose narratives, verse, and scholarship about his native land will inspire many generations of Kansans to come

Executive Summary

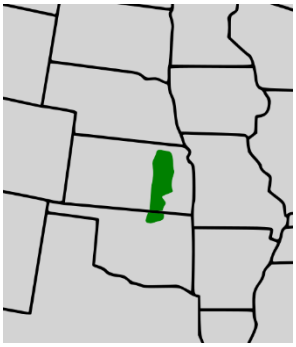

Figure 1: The Flint Hills tallgrass prairie, in green. Source: Wikipedia.

The entire State of Kansas, in the popular imagination, is "flat as a pancake," as far as the eye can see. In fact, Eastern Kansas is home to the remarkably scenic, undulating Flint Hills, also known as the Osage Hills in Oklahoma. These hills host the last remaining landscape expression of tallgrass prairie left in North America (see Figure 1)[1]. Within the past several decades, the Flint Hills have become the focus of an innovative conservation effort that includes The Nature Conservancy (TNC), the U.S. National Park Service (NPS), the U.S. Fish and Wildlife Service (USFWS), the Tallgrass Legacy Alliance, the Ranchland Trust of Kansas, the Kansas Land Trust, local ranchers, and other private landowners. Together, they are collaboratively stewarding some five million acres of tallgrass prairie.

Brian Obermeyer, who today serves as the director of protection and stewardship for The Nature Conservancy in Kansas, was in 2002[2] about one year into the job of leading a community-based conservation initiative in the Flint Hills when he was first introduced to wind energy. While driving through Iowa to attend a conservation meeting being held in Minnesota, he noticed a new generation of windmills that appeared on the horizon. Obermeyer well understood the importance of renewable energy in helping to mitigate climate change, but it soon occurred to him that if wind turbines were erected in the wrong places they could cause a major disturbance to wildlife habitats essential to the survival of plants and animals endemic to the Flint Hills, and across the Great Plains of North America.

What Obermeyer and a few collaborators started with at that time has evolved over the subsequent two decades into a nearly continental scale effort. It is now a scientific research and wind-siting protocol effort involving local and regional scientists across the center of the nation. Named Site Wind Right, the effort is helping to shape the geospatial configuration of a new generation of electric power facilities in the American wind belt, from Texas to North Dakota, and from Ohio to Montana. It represents a way to proactively plan for biodiversity-sensitive siting of wind farms across a continental wind resource. And the practice of systematically taking wildlife habitat into wind facility siting analysis is now gaining attention from policy analysts, engineers and senior corporate executives from Argentina to Australia.[3]

Conceptually, the Site Wind Right idea is fairly straightforward. An initial step is to make a comprehensive geographic information system (GIS) map of the places that have "suitable" wind resources for power generation in the geographic range of interest (in this case, a wind resources map layer of the American Wind Belt). The second step is to map out areas overlapping with the range or habitat of an endemic species (a biodiversity layer), such as the migration route for the whooping crane, along with areas of potential engineering and land use restrictions (an infrastructure layer). The final step is to overlay the wind resource layer with the biodiversity and infrastructure layers, thereby showing the locations with suitable wind

resources and few or no wildlife or infrastructure conflicts – yielding a map of suitable, low-impact sites.

What sounds like a relatively straightforward task turns out to present multiple challenges. Gathering and mapping the biodiversity knowledge of hundreds of experts, at a multitude of institutions, is a non-trivial task that can take many years to complete and which requires regular updating. The wind resource map, and the location of land use constraints, also require updating, but the data is fairly well understood and readily available. In addition, once the data is in hand, it has to be shared, understood, and used to site and operate wind farms by potential developers and operators; utilities; transmission companies; regulators; politicians at the local, state and national level; corporate buyers; families and individuals.

In the Flint Hills, the good news is that the challenges appear to be manageable, and the range of suitable, low-impact sites for wind development within the 17-state area of interest is expansive. An in-depth (but not exhaustive) study by TNC staff indicates that approximately 222 million acres (about 89.8 million hectares) of land in the study area has suitable wind resources; of that, about 90.4 million acres (36.6 million hectares) is considered to be both suitable and low-impact from a wildlife and habitat point of view (not including engineering or land use constraints). That is equal to the land area of about nine percent of the 17-state region. Based on the nameplate capacity of wind turbines at three Megawatts per square kilometer,[4] those acres could accommodate 1,099 Gigawatts of wind power capacity on low-impact, suitable land – an amount of power 10 times as great as all U.S. wind generating capacity in 2019, and "equivalent to the total generating capacity from *all* sources" in the United States in 2018.[5]

The Site Wind Right map is not seen by its authors as being the definitive authority on wind turbine siting in the central United States. They suggest that more finely grained analysis and regulatory guidelines, such as those issued by the USFWS, the Federal Aviation Authority and local authorities should, of course, also be adhered to.

Nevertheless, the big picture presented by the Site Wind Right methodology remains highly useful. There are myriad sites in the U.S. wind belt where large numbers of wind turbines may be sited as conservationists continue to protect wildlife and habitat. Furthermore, continued research and scientific advances will allow us to have greater precision regarding where to best site renewable energy facilities, at the same time that we are able to be good, long-term stewards of natural heritage.

The Site Wind Right methodology is also having an impact outside of the United States. In locations such China and India, wind facility siting programs are emerging, crafted to suit local conditions and legal frameworks, encouraging wind energy developers to site their projects at low-risk sites in those nations. Furthermore, a recent report released by the International Union for the Conservation of Nature (IUCN) on mitigating the impact of wind and solar energy developments cites both Site Wind Right and a complementary TNC study focused on planning renewables projects, "Power of Place", as relevant examples.

As both wind and solar technologies in the U.S. and worldwide are deployed at unprecedented rates over the next several decades, a more holistic approach to renewable energy siting and planning will continue to emerge. If the international community is to reach ambitious biodiversity conservation goals, such as protecting 30 percent of the earth's land area by 2030, mitigating "energy sprawl," will be imperative; and that includes the siting of renewables in low-risk areas The methodology for doing so, already 20 years in development at The Nature Conservancy, must continue to evolve, if land and water resources are to remain largely intact for future generations.

Introduction and Context

Brian Obermeyer is a fifth generation Kansan. Two sets of his great-great grandparents homesteaded along the western flank of the Flint Hills soon after the Civil War. The rest arrived by the late 1880s. Members of Obermeyer's family have been there ever since. He is, literally, at home on the range with both ranchers and conservationists. He is also comfortable arguing his case for the protection and stewardship of the land before academic audiences at places like Emporia State University, where he received his master's degree in Environmental Biology, as well as in front of large groups of city folk who come to the Flint Hills to hear the Kansas City Symphony play in the open air each June.

Anyone who has had the chance to ride out with him in his pickup to see the prairie grass waving in the wind, and the buffalo roam along a ridge, can tell you how passionate Brian is about the land. You can glean the same insight from his writing. Consider, for instance, the following excerpt from an essay written by Obermeyer for the 2012 Symphony in the Flint Hills. The prose describes the 'know-it-when-you-see-it" method of discovering when you have entered the Flint Hills.

> You might be in the Flint Hills where there are miles upon miles of intact, native tallgrass prairie carpeting smooth-sculpted, rolling hills; where a wind-swept, prairie ridge comes alive each spring morning with the mating calls and dances of greater prairie-chickens; where an orange horizon and the smell of prairie smoke does not cause panic, but is rather a sign that winter has waned; where slabs of limestone form a rim along pasture hillsides; where you can still watch real cowboys moving cattle on horseback; and where an Osage orange (hedge) post is the tallest perch around for an upland sandpiper to perch, raise its wings, and exhale its distinctive "wolf-whistle."[6]

About five years after earning his master's degree, Obermeyer landed a job with The Nature Conservancy (TNC), the largest conservation non-profit organization in the world.[7] His new job as Director of the Flint Hills Initiative, was focused on preserving the unfragmented nature of this last expanse of tallgrass prairie, a goal Obermeyer would prioritize for the better part of the next two decades. In addition to writing about the Flint Hills and conducting scientific research, he helped secure conservation easements on lands owned and managed by ranching families.

Early in his career with TNC, Obermeyer saw his first utility scale windfarm while driving through fields of corn in Iowa on his way to a conservation meeting in Minnesota. His first thought was "wow, that's cool!" As he stopped to explore and admire the site, Obermeyer had a second, and less positive thought. He realized that large arrays of wind turbines could have significant, negative impacts, if sited in natural habitats like the Flint Hills. He knew very well that without some mitigation or regulation, surviving populations of prairie chickens and other species that need open space could be further diminished or disappear from the landscape. His concern grew as he learned, on his return to Kansas, of three proposals to erect wind turbines in the heart of the Flint Hills.

Given his concerns about the potential negative impacts of wind development and how it might affect landscapes like the Flint Hills, Obermeyer called Bill Weeks, then a recently retired senior executive at TNC. He asked Weeks for advice on how TNC should deal with wind, a climate friendly energy source which potentially posed a threat to conservation values at the heart of TNC's mission. Nearly twenty years later, Obermeyer clearly remembers Weeks' sage advice: "A threat is a threat and should be treated as such." Weeks' matter-of-fact response gave Obermeyer the confidence he needed to not be shy about addressing ecological concerns related to wind development.

Obermeyer heard from friends and read editorials by local luminaries opposing wind development in the Flint Hills. Most prominent were the concerns of Jim Hoy, a beloved professor of English at Emporia State. Hoy wrote in a local newspaper, the *Marion County Record*:

> Don't get me wrong, I'm not opposed to alternative energy sources. In fact, I think that we should be, and all along should have been, doing a lot more to supplement our petroleum energy supply with solar, wind, and waterpower.
>
> It seems to me, however, that there's a right way and a wrong way to go about this process, and the right way is not to trash the most beautiful landscape in Kansas. Admittedly, I'm reacting to this threat to my geographical and spiritual home without a full understanding of who and what is involved, but then the energy companies have not exactly been forthcoming in publicizing their moves.[8]

Obermeyer was also aware of the positions of other conservation groups opposed to the loss of native tallgrass prairie. One of the most well established was the Tallgrass Legacy Alliance (TLA), which had been around since 1999. It was "initiated as a partnership effort among local ranchers, agricultural and conservation organizations, and representatives from state and federal agencies, including key initial support by the Kansas Partners for Fish and Wildlife Program." In the terminology of the George W. Bush administration, it was, along with the Blackfoot Challenge in Montana, helping to pioneer the community conservation movement. The TLA was proud to point to its roots deep in the local community, crediting its success to "the ranching

families that have so willingly allowed the Partners Program into their homes and their lives. A level of trust that could surely be called 'friendship' is what drives the TLA."[9]

Local advocacy also came from a group that, prompted by the concern of multiple wind development proposals in the Flint Hills, first convened in the town of Matfield Green, Kansas, in the summer of 2002. That group, calling itself "Protect the Flint Hills," declared that: "Our mission is to protect the wide-open spaces of the KANSAS FLINT HILLS, the last significant expanse of tallgrass prairie on the continent." The group's vision statement is similarly forthright:

> We strongly oppose placing industrial wind energy complexes in the Flint Hills. The Flint Hills region is not a renewable resource. It's a one-of-a-kind landscape. Industrial wind turbines should be placed on land that has already been fragmented by farming or other development. Why fragment and compromise this unique and endangered Tallgrass Prairie ecosystem with industrial development when Kansas has over eight million acres of already fragmented land with good wind resources?[10]

On the other side of the debate were wind developers, ranchers ready to lease their land for wind development, and renewable energy proponents who were putting considerable investment and personal energy into seeing wind generating capacity expand in Kansas. By the early 2000s, they could envision a bright future for wind capacity in the state. From a base of only 2 Megawatts (MW) of capacity in 2000, they saw capacity expand more than 50-fold to 114 MW by 2001.[11] As the development pipeline filled with ever-increasing numbers of project proposals, developers, renewable energy advocates, and many of the state's politicians could see a wind energy wave coming, and they wanted to stake their claims wherever feasible.

The debate started to show up in published materials. In August 2002, a Kansas TNC newsletter ran a story titled, "Industrial wind development in the Flint Hills: where does TNC stand?" In the fall of 2002, the Wildlife Management Institute (WMI) published several articles on the potential impact of wind development on upland birds. A committee of the Kansas Renewable Energy Working Group, led by Obermeyer, began work on drawing up wind turbine siting guidelines that same fall.

As the conversation intensified, Obermeyer had the opportunity to work more closely with Rob Manes, who at the time worked for WMI. Manes (pronounced "Maine-us") had a master's degree in Environmental Science from Friends University in Wichita. He had spent about two decades with the Kansas Department of Wildlife and Parks prior to coming to WMI in the early 2000s. Manes and Stephanie Harmon—later to become Stephanie Harmon Manes—had written the first of the WMI published articles on the potential impact of wind farms on wildlife habitat. Another was written by Obermeyer.

Teaming up on a topic of mutual concern, Manes and Obermeyer, representing TNC Kansas and WMI, agreed to co-organize a workshop in Kansas City in March 2003 focused on Great Plains wind power and wildlife. It was at that workshop that Manes argued for the group to look at the

problem through a new lens. He suggested that the land and wildlife conservation community focus on where wind turbines *could go*, as well as where they should not be sited. While the idea at first seemed unwieldy and perhaps impractical, it turned out to have great potential. It also turned out that Manes and Obermeyer, as well as many other conservation practitioners, field biologists, ecosystem scientists, computer modelers, and others, would continue to work together on the problem for years to come.

In May 2003, Obermeyer and Manes again teamed up to go to Washington, D.C. to speak at a Department of Interior meeting on wind energy siting. They also spoke to staff from Kansas' legislative delegation. According to Obermeyer, their talk was both detailed and specific, and touched on siting, project design, operation and maintenance, density of wind turbine placement, infrastructure placement and design, and potential mitigation in cases where native landscapes are sacrificed for wind farms. While Manes and Obermeyer did recommend the use of information from Landsat Thematic Mapper, they had not yet conceptualized the need for a regional mapping tool that could help guide a developer to an appropriate wind project site.

While Obermeyer and Manes were busy at work focusing on the potential impact of wind development in Kansas, similar concerns were emerging in Oklahoma. The first two modern wind farms in that state both became operational in late 2003 near the towns of Lawton and Woodward. The Blue Canyon Wind Farm near Lawton was sited just northwest of the 59,020 acre Wichita Mountains National Wildlife Reserve, home of the 8,570 acre Wichita Mountain Wilderness Area.[12] Local wildlife advocates became concerned about the impact of the Blue Canyon site on migrating birds, and about the project's potential to further fragment the landscape. Chris Hise, TNC manager of the Four Canyons preserve in western Oklahoma, 35 miles south of Woodward, became aware of these issues and began to attend meetings regarding wind siting, such as the one held by the USFWS in Wichita, Kansas in 2003.

It was at that meeting that someone suggested that the conservation community should produce a map that showed where potential conflicts between wind farms and wildlife might appear. Hise, a polymath considered by his colleagues to be a GIS wizard, took the idea to heart and began to produce what he now considers in 2020 to be a "crude, quaint map" to fulfill that request. Months later, when a wind farm was proposed to be sited near a prairie chicken habitat in Western Oklahoma, he realized the potential importance of his map.

Kansas Governor Kathleen Sebelius, a Democrat who would later become Barack Obama's Secretary of Health and Human Services, also took an interest in wind development planning and siting. She met in the summer of 2003 with a delegation of Kansas ranchers, landowners, and conservationists, including Obermeyer, to discuss the situation. As a result of that meeting, a new group called Tallgrass Ranchers was formed. Following a meeting of the group in September 2003, Tallgrass Ranchers issued an unambiguous policy statement.

> According to Frank Sabatini of Topeka, a member of the group's Executive Committee and a Wabaunsee County ranch landowner, the placement of industrial wind turbine

> complexes in the tallgrass region of Kansas is inappropriate and would have a series of adverse impacts.
>
> The policy statement approved at the meeting outlines the primary concerns of the Tallgrass Ranchers. According to the statement, industrial scale wind power developments are: 1. Incompatible with the pastoral and cultural character of the tallgrass prairie; 2. Would damage the scenic beauty, wildlife, and unique ecological nature of the area; 3. Would reduce the enjoyment of life and property values of neighboring private landowners; and 4. Would change the character of the tallgrass prairie from agricultural to industrial.[13]

By December 2, 2003, Sebelius decided to appoint a task force to examine the issue. She asked Lee Allison, head of the Kansas Geological Survey, based at the University of Kansas, as well as Chair of the State Energy Resources Coordinating Council (SERCC), to form a group "composed of individuals from a wide variety of backgrounds and experiences that will ensure adequate consideration and analysis of all relevant issues...[m]y administration is hopeful that some consensus can be reached about the delicate balance between encouraging economic development of environmentally sensitive energy resources and the protection of the prairie" (emphasis added). Alan Pollom, then Director of the Kansas Chapter of TNC, was a member of the Task Force, which was asked to report back to the Governor by the end of May 2004.[14] The final report was delivered to the Governor on June 7, 2004.

The governor also asked Allison to assemble a mapping team to delineate the most important areas of the Flint Hills. The team was comprised of GIS experts as well as conservation professionals, including Obermeyer. The map team was nearing completion of the GIS map layers when, in November of 2004, the governor's office was forced to make a decision over a large wind farm in Chase County. The project was on a fast track for development and would have been well within view of Tallgrass Prairie National Preserve. The governor and her cabinet decided to endorse much of Option A of the task force's report, which included the following: "Enact, at a minimum, a one-year moratorium for commercial WECS [Wind Energy Conversion Systems] in the Flint Hills." The timing of the Chase County wind project meant that the governor was unable to wait for the mapping committee to complete its work. Instead, Sebelius' staff created a map defined by roads and administrative boundaries, rather than via a GIS analysis. The governor's boundary was referred to as the "Heart of the Flint Hills." Governor Sebelius was able to persuade the power purchaser of the Chase County project to choose a different wind project (Elk River Wind Farm, south of U.S. highway 400), but that unfortunately was in an area of intact prairie as well.

Fearing the governor's moratorium might not be enough to stop eventual development, citizens of Wabaunsee County, in the north-central portion of the Flint Hills, were able to pass a zoning ordinance that banned industrial wind farm development within its borders in 2006. The zoning ordinance was upheld by the Kansas Supreme Court in 2009.[15] Presenting an even-handed policy position, Sebelius urged "wind energy developers to move quickly on projects" outside of that

area.[16] She was, as she had charged the task force to do, striving to achieve a balance between economic development and protection of the prairie. She subsequently came to endorse ambitious state wind power production goals, calling in her 2007 State of the State address for Kansas wind power to produce 10 percent of the state's demand by 2010, and 20 percent by 2020. In actuality, wind power represented more than 41 percent of Kansas' electric demand in 2019.[17]

Meanwhile, on the Oklahoma side of the border, Chris Hise completed his project and shared it with partners in 2004. Updated in August 2005 this innovative geographic information system (GIS) map was titled: *Oklahoma Natural Resources: Wind, Wildlife, Untilled Landscapes, and Protected Areas* (see Figure 2[18]; source: The Nature Conservancy).

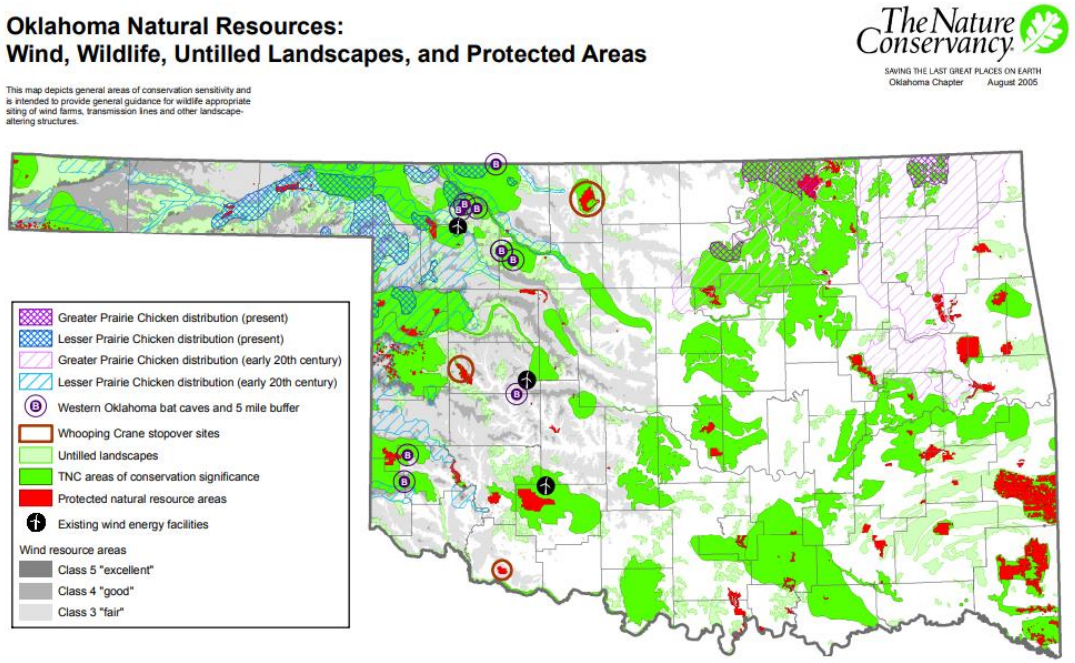

Figure 2: Oklahoma Natural Resources: Wind, Wildlife, Untilled Landscapes, and Protected Areas. (Source: The Nature Conservancy)

A caption included by Hise explains that "[t]his map depicts general areas of conservation sensitivity and is intended to provide general guidance for wildlife appropriate siting of wind farms, transmission lines and other landscape altering structures." As such, it is "the first comprehensive 'spatial planning tool' for wind development in the United States." Hise's map, issued under the name of The Nature Conservancy Oklahoma Chapter, proved an impressive first effort, setting a baseline of sorts for subsequent Site Wind Right maps produced more than a decade later.

With all of the wind-focused conservation efforts coming to the fore, the Kansas Chapter of TNC hired Manes in 2005 as its director of conservation programs. Now together in the same organization, Manes and Obermeyer tried to figure out how to create a program to properly site

wind farms in Kansas. Along with Chris Hise and TNC Oklahoma, and, from time to time, TNC Oklahoma Chapter Director Mike Fuhr, they wanted to devise some sort of Green Certification Program for wind farms in Kansas and Oklahoma that might incentivize sustainable siting. However, they found it challenging to establish an effective green certification program, particularly in an era when wind capacity was growing so rapidly. Between 2004 and 2009, wind capacity in Kansas grew from 114 MW to 1,021 MW, at a rate of about 159 percent per year. Over the same five years, Oklahoma wind capacity grew at a rate of about 98 percent per year, from about 176 MW to 1,038 MW.[19] The expansion of capacity in Kansas included two wind farms located to the south of the Heart of the Flint Hills area designated for protection by Governor Sebelius: the 150 MW, 100 turbine Elk River Wind Farm; and the 111 turbine, 200 MW Caney River wind.[20]

In their efforts to identify an effective green certification process, Obermeyer and Manes were able to turn to members of TNC's science team for advice. A key resource on that team was Joe Kiesecker, a prolific author with a Ph.D. from Oregon State University, who had held faculty appointments at Yale and Penn State. Kiesecker joined the Conservancy in 2004, and based in Fort Collins, Colorado, he became lead scientist for The Nature Conservancy's Conservation Lands Team, while holding an ongoing faculty appointment at the University of Wyoming in Laramie.

Kiesecker came to TNC wanting to not only study biodiversity decline as a scientist, but to also help slow or reverse the decline's trajectory. At TNC, his attention soon turned to what he calls "energy sprawl," or the expanding global footprint required to produce all of the energy humans consume. Energy sprawl is the *product* of the amount of energy produced in a given region *and* the land-use intensity of the production (e.g., acres of land disturbed by oil and gas development, or by windmills, per unit of energy produced in a given county). Kiesecker helped envision a strategy that came to be known as "Development by Design," based on his quick understanding of the phenomenon from the oil and gas fields of Wyoming and the grassy steppes threatened by energy and mining development in Mongolia. In a landmark paper he authored in 2009 with Holly Copeland, Amy Pocewicz, and Bruce McKenney, Kiesecker focused on the same challenge that Kansas Governor Sebelius had aimed to address in 2003. Kiesecker *et al* explain:

> With the mounting pressure on natural resources as human populations grow, there is increasing urgency to find ways to balance these growing needs with those of conservation.

The 2009 paper advocates for the use of "conservation planning, in combination with the mitigation hierarchy [to] guide decision making about where impacts to biodiversity can be offset, and where they should be avoided or minimized."[21] One of the key insights of the paper is that the more established "mitigation hierarchy" practice established by the U.S. Environmental Protection Agency to "avoid, minimize and restore, or offset" environmental impacts can lack "quantitative guidelines … to guide this decision-making practice." Adding conservation planning

to the mix, however, such as that suggested by Craig Groves in his 2003 book, *Drafting a Conservation Blueprint*,[22] provides a framework to "ensure that mitigation efforts are consistent with conservation goals; this often includes the maintenance of large resilient ecosystems to support both healthy wildlife habitats and human communities."[23]

One of Kiesecker's collaborators on the "Development by Design" paper, Bruce McKenney, was at the time of the paper's publication a senior economic advisor at The Nature Conservancy. In 2010, presumably due to the impact of the essay, his title at TNC changed to director, development by design, a job title he kept for the next eight years. During that time he worked as part of TNC's Global Team to lead the implementation and adaptation of the Development by Design strategy, including through participating in such forums as the World Economic Forum's Global Agenda Council. McKenney continues to be engaged in global strategy for TNC, having in 2018 become TNC Director for Strategic Initiatives, Energy & Infrastructure.

Parallel to the effort to produce the Development by Design methodology, from 2008 to 2010, Rob Manes of TNC Kansas served as one of 22 representatives of government agencies, corporate interests, non-profit organizations, Native American tribes and academic institutions on the federal Wind Turbine Guidelines Advisory Committee. That committee, established on October 26, 2007 under the Federal Advisory Committee Act, issued a set of recommendations on March 4, 2010.[24] The recommendations produced by the committee were not intended to have the force of regulation, but to serve as voluntary guidelines. They were endorsed by Interior Secretary Ken Salazar and USFWS Director Dan Ashe on March 23, 2012, and published on the same date, as the Land-Based Wind Energy Guidelines.[25] What the guidelines recommend is that wind developers follow a five-tier series of steps to assure compliance with USFWS regulations and federal law. The five tiers are as follows:

- Tier 1 – preliminary site evaluation (landscape-scale screening of possible project sites);
- Tier 2 – site characterization (broad characterization of one or more potential project sites);
- Tier 3 – field studies to document site wildlife and habitat and predict project impacts;
- Tier 4 – post-construction studies to estimate impacts;
- Tier 5 – other postconstruction studies and research.

In actuality, wind developers face a wide range of voluntary and compulsory regulatory frameworks, based on the jurisdictions where a wind facility is intended to be sited. Those projects sited on federal lands must abide by relevant compulsory federal regulations, and they may choose to abide by voluntary guidelines as well. According to the National Conference of State Legislatures, such voluntary or compulsory frameworks may be from local governments solely, from a hybrid of state and local governments, from state governments only, or, in several cases, no standard set of local or state regulations. Accordingly, the weight given to federal voluntary guidelines varies widely from state to state, and locality to locality, depending in part on the volume of local and state regulations that apply.[26]

Continuing to elaborate the Development by Design framework, Joe Kiesecker, Jeff Evans, Joe Fargione, and six additional collaborators got together to write a paper showing the vast capacity for wind energy development on lands already disturbed by human activity in the 48 "lower" United States. The paper, "Win-Win for Wind and Wildlife: A Vision to Facilitate Sustainable Development," was published in April 2011. Joe Fargione, a Ph.D. from the University of Minnesota, who had become TNC Lead Scientist for North America by 2010, proved to be a particularly important co-author. Fargione had devoted attention to wind resources since 2008 with the help of grants from the World Wildlife Fund, the U.S. Department of Energy, and the American Wind and Wildlife Institute.[27] In the introduction to the paper, the authors explain:

> In this study we examine patterns of wind energy potential in terrestrial landscapes that are already disturbed by human activities (e.g., agriculture, oil and gas development). Although other studies have estimated the total amount of potential wind-energy production available in the U.S. and globally, this is the first to examine if renewable energy goals can be met on disturbed lands that could reduce conflict with wildlife.

In the paper's section on Results, the co-authors go on to report that:

> Our analysis indicates that a network of land-based turbines… has the potential to generate 7,705 GW in the lower 48 United States, with potential for 3,554 GW in areas already disturbed by human activities. Given a DOE projection of 241 terrestrial GW [projected for wind, equal to about 20% of projected U.S. demand in 2030], there is ample opportunity to meet this goal in areas likely to have relatively low wildlife value.

To encourage the placement of turbines on already-disturbed lands with good wind resources, the authors also encourage consideration of targeted subsidies. They suggest that, in combination with selective mitigation requirements, some incentives may be necessary to achieve the desired mitigation of potential environmental impacts.

> Targeting state and federal subsidies to favor low-impact developments and creating avoidance and mitigation requirements that raise the costs for projects impacting undisturbed lands could maximize public value for wind energy and wildlife requirements… As wind development increases, conflicts over impacts to wildlife are likely to become increasingly important. Thus, a proactive approach that seeks to avoid impacts to wildlife will reduce overall costs and facilitate wind development.[28]

The approach generally outlined in the April 2010 "Win-Win" paper was soon followed up in October 2011 with a more geographically focused analysis published in *PLOS One*: "Development by Design: Mitigating Wind Development's Impacts on Wildlife in Kansas." It was authored by four key individuals engaged in the development of TNC's approach to wind in the state: Brian Obermeyer, the field conservationist who was instrumental in kicking off the TNC Kansas focus on properly siting wind farms in the early 2000s; Rob Manes, Obermeyer's colleague, who would within a year be named TNC State Director for Kansas; and the "two Joes," Kiesecker and Fargione, the TNC scientists who had taken the lead in framing the "Development by Design" and

"Win-Win for wind and wildlife" strategies. Kei Sochi was also listed as an author; a "spatial ecologist" fluent in GIS, she had been acknowledged in earlier papers, but this was the first in the series on wind siting in which Sochi, whose maps became such an important part of the analysis, was listed among the authors.

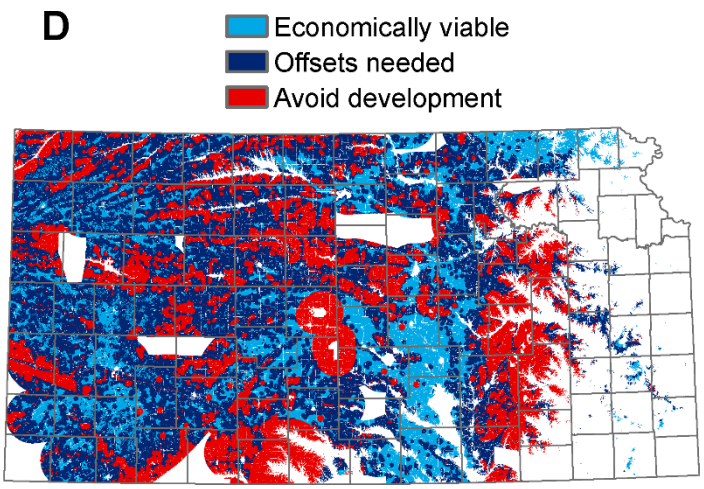

Figure 3. "Avoidance and mitigation areas [in Kansas] superimposed over areas of potential wind development; remaining light blue areas indicate areas suitable for wind development where mitigation would not be required." (Source: Obermeyer et al, October 2011.)

The October 2011 paper includes analys of lands in Kansas that are economically viable for wind development, should be avoided entirely, could be developed with mitigation (that is, "offsets needed"), and could be economically developed for wind without mitigation ("without offsets"). Kei Sochi's map, below, shows each of these areas. By doing so, the paper further develops the GIS concepts used in later Site Wind Right maps (see Figure 3, source: The Nature Conservancy).

Similar to the earlier paper focused on a much larger area, the authors find more-than-ample acreage for wind turbine siting in Kansas.

> Within Kansas there are approximately 14.5 million ha suitable for wind energy development (based on wind power class, distance to current and proposed transmission, and excluding urban and protected areas). If all of these areas were developed for wind energy, they could support approximately 668 GW of electrical capacity… After removing the wildlife avoidance areas that we identified, approximately 10.3 million ha remain as suitable for wind energy development. This "open" area is capable of yielding approximately 478 GW of electrical capacity… Even after removing both the wildlife avoidance areas and all areas where mitigation payments would be required, there are approximately 2.7 million ha suitable for wind energy development where no mitigation payments would be required (13 percent of the state). This area would be capable of supporting approximately 125 GW of electrical capacity. Note that the DOE goal for wind energy in Kansas is 7.16 GW, so even if all wind development was restricted to lands where no mitigation payment is needed, the wind capacity on these lands is 1,648 percent higher than (over 17 times higher than) the DOE goal. [29]

While continuing to leave the door open to mitigation, the authors suggest that the most economic path would be to avoid areas requiring mitigation.

Wind energy developers can use the results of this analysis to proactively reduce the need for mitigation by siting projects in areas that would not warrant mitigation. This could substantially reduce the cost of mitigation across projects.

As evidence that wind developers who had already completed projects in Kansas were generally sensitive to the problems and costs associated with wildlife conflicts, the authors offer the following.

> The fact that 85 percent of existing wind turbines are sited outside of areas incompatible with conservation further supports our argument that it is possible to develop wind energy without compromising conservation goals.

Finally, the authors suggest that a green certification process, endorsed by key industry and financial players in the electric power business, could serve as an effective incentive to developers to avoid sensitive areas. Such certification would be available to developers that use sites requiring no mitigation as well as sites that appropriately use mitigation techniques.

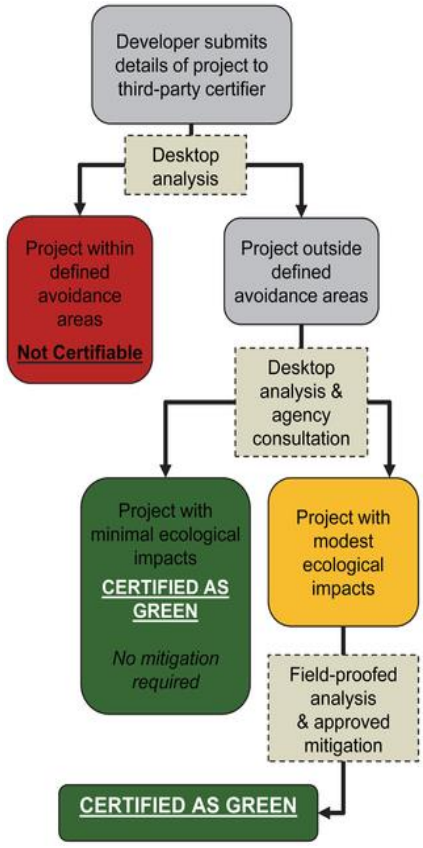

Figure 4. Schematic showing proposed steps of a Green Certification process for wind energy development. (Source: The Nature Conservancy)

> Our research illustrates that it is presently possible to implement a landscape-scale system that guides wind energy development to avoid, minimize, and offset ecological impacts. The approach outlined here, updated with new information as it becomes available, could be used to award "Green Certification" to projects that follow this protocol. The steps that would be necessary to achieve certification are illustrated in Figure 4. Certification against the guidelines presented in this paper may help to expand and sustain the wind industry by facilitating the completion of individual projects sited to avoid sensitive areas and protecting the wind industry's reputation as an ecologically friendly source of electricity. Endorsement of a Green Certification process by electric utilities and financial backers would provide incentives for wind developers to seek certification for new facilities.[30]

One more paper in the Wind and Wildlife series, focused on the Northern Great Plains, adds an additional important perspective to this train of analysis. "Wind and Wildlife in the Northern Great Plains: Identifying Low-Impact Areas for Wind Development," was published in July 2012, and authored by Joe Fargione, Joe Kiesecker, Jan Slatts and Sarah Olimb. The authors find that, across Nebraska, Wyoming, Montana, North Dakota and South Dakota in the United States, and

southern Alberta and Saskatchewan in Canada, there "are large areas where wind could be prioritized that would likely have little impact to wildlife." They found enough "to produce over 35 times the projected wind development goals." However, unlike Kansas, they found that:

> The majority (70 percent) of proposed development in the Northern Great Plains is outside of the low-impact areas we have identified, suggesting that the current regulatory framework is generally insufficient to ensure low-impact development. Currently, conscientious developers who avoid a site that has substantial wildlife impacts may be at a competitive disadvantage because a competitor could subsequently develop the site. Consequently, relying on individual developers to voluntarily improve siting practices is unlikely to achieve desired conservation outcomes, because sensitive areas avoided by one project can be easily impacted by subsequent development. Also unlikely, for political reasons, is significant additional regulation in the NGP that restricts the development of wind resources on private lands based on wildlife concerns. Rather, improved incentives such that conscientious developers receive a competitive advantage will likely be necessary for widespread adoption of wildlife-friendly development practices. We identify four areas where action to help change incentives is needed: 1) transmission line siting; 2) formal guidelines and certification; 3) utility power purchase decisions; and 4) appropriate compensatory offsite mitigation for unavoidable impacts.[31]

Even as TNC field staff and scientists worked to devise a green certification program and compensatory offsite mitigation protocols for the expanding number of wind farms across the Great Plains, the defenders of open prairie vistas were making progress in designating large areas around the Flint Hills as eligible for federally-funded conservation easements. On November 12, 2010, U.S. Secretary of the Interior Ken Salazar designated a 1.1 million acre "Flint Hills Legacy Conservation Area" (FLHCA). [32, 33] Within the boundaries of the FHLCA, the USFWS was granted authority to acquire conservation easements to complement the 45,000 acres of existing conservation areas. These existing conservation areas included, at the time, the Konza Prairie near Manhattan and the Tallgrass Prairie National Preserve.

In May 2011, Kansas Governor Sam Brownback, who succeeded Kathleen Sebelius, officially designated the "Tallgrass Heartland," an area that encompasses Sebelius' Heart of the Flint Hills, as well as most of the Southern Flint Hills, essentially doubling the area of native prairie to be free from additional commercial wind farm development."[34] This designation was enthusiastically supported by Tallgrass Ranchers, Audubon of Kansas, and Protect the Flint Hills. Their endorsement was made, notwithstanding the fact that, prior to Brownback's moratorium, some wind farm installations (for example, the Caney project in Elk County, Kansas) had been initiated and would be completed in the area of expanded protection.

As scientific and gubernatorial-level siting restrictions continued to evolve, TNC continued to seek out ways to work with private landowners to get them to voluntarily avoid building wind farms, as well as oil and gas facilities, in places that would disrupt wildlife. For example, Chris Hise of TNC Oklahoma collaborated with the Oklahoma Department of Wildlife Conservation, the

USFWS, Playa Lakes Joint Venture, the George Miksch Sutton Avian Research Center, Oklahoma State University and the Office of the Oklahoma Secretary of Environment to build a spatially-based planning tool focused on protecting the lesser prairie chicken in Oklahoma. The resulting paper was part of an effort to mitigate the decline of the lesser prairie chicken so that it would not be listed as an endangered species by the U.S. Fish and Wildlife Service.

In an introduction to the somewhat academic paper on the effort, the authors explained that the "Oklahoma Lesser Prairie-Chicken Spatial Planning Tool (OLEPCSPT 2010) is a spatially explicit model designed to assist development planning by avoiding, minimizing and mitigating negative effects of development on the lesser prairie-chicken in Oklahoma..." While the meticulously assembled model, published on March 1, 2010, carefully examined the significant landscapes for lesser prairie-chicken conservation, the authors went on to explain the model's limitations: "it is extremely important to understand that the Oklahoma Lesser Prairie-Chicken Spatial Planning Tool does not address, or attempt to address, any other potential concerns to natural resources within the modeled area … except the LEPC. There may be additional natural resource concerns (e.g., public conservation lands, rare or sensitive habitats, state species of concern, federally listed species, and others) within the area that was modeled requiring developer's consideration and evaluation to ensure compliance with appropriate state and federal laws and ongoing conservation initiatives."[35] In short, the complex analysis, while it appears to follow logic closely aligned with the Development by Design methodology which TNC was instrumental in developing, could only help with one of many potential wildlife conflicts in the region. The proponents of the Lesser Prairie Chicken Spatial Model struggled to make the tool useful to a broad community of potential users that were making decisions about where to site wind turbines.

The Challenge/Problem Statement

By 2013, The Nature Conservancy teams in Oklahoma and Kansas came to understand that their efforts to steer wind siting based on the "avoid, minimize and mitigate" hierarchy, as applied separately in each state, was not gaining sufficient traction. Mike Fuhr, who directed Oklahoma operations and Rob Manes, his counterpart in Kansas, decided to pool financial and human resources to build a GIS model showing the best places to site wind farms across the states of Kansas, Oklahoma, and in the Texas panhandle. They thought that the larger geographic scope of such an effort might have a larger regional impact. They also came to realize that they needed a simpler set of maps focusing on the more-than-abundant sites with good wind resources where mitigation would not be necessary. Conceptually, such maps would be far easier to communicate to an audience of developers, utilities, and power customers.

The challenge, essentially, was to scale up and simplify the GIS analysis, and then to present the findings, with effective messaging, to the right audiences.

The articulation of the challenge was offered at a presentation made by Jim Hays (representing himself, Brian Obermeyer, Chris Hise and Jay Pruett of TNC) at a discussion moderated by Taber Allison at a meeting convened by the American Wind Wildlife Institute (AWWI).

> TNC has been working on wind development in the Great Plains for many years. The Kansas and Oklahoma chapters began collaborating on a GIS assessment in 2013 to help address some of the questions we had been asked, over time, regarding wind siting in the two states. We started out talking about mitigation of potential negative impacts but came to the conclusion that there is significant development potential in low-risk areas, and that ambitious wind development goals may be fully realized (and far surpassed) by siting projects exclusively in areas with low risk of wildlife conflicts.
>
> While we recognized that risk cannot be entirely eliminated—due to data gaps, impacts to wide ranging species, and so forth—we expected that this type of spatial assessment could reduce administrative burden, risk profile, and total cost relative to the standard mitigation hierarchy approach. Such a product could facilitate the efficient build out of wind energy while minimizing risks to wildlife.
>
> [Our objective is to develop] a spatial assessment based on existing literature that greatly reduces the potential for major wildlife conflicts, using TNC's 'Development by Design' approach. Furthermore, our approach seeks to minimize the use of statistics and complex map outputs to make a product that a broad audience of stakeholders–wind developers, local government officials, power purchasers, land owners – can easily understand and use to realize ambitious wind development goals. [36]

Strategy and Implementation

One of the first attempts TNC launched to address this challenge was called the Central Great Plains Grasslands Initiative, aimed at protecting areas of native prairie (highlighted in dark green) in Kansas, Oklahoma and the Texas Panhandle (see Figure 5). The initiative crossed the boundaries of three states, and aimed to partner with public, private and Native American partners to achieve its conservation mission. In the summer of 2013, at a Partners in Conservation luncheon, Mike Fuhr articulated TNC's goals for the initiative. These included an ambition to "develop oil and gas and renewable energy in the best way possible – working with landowners, oil and gas and wind energy industry leaders to develop new, collaborative solutions to make sure that energy production uses siting and best management practices that minimize impacts to nature."[37]

Site It Right

A map composed by Chris Hise and published around 2015 showed how wind energy development might be accomplished. Rather than featuring areas that are high priorities for conservation, as in Figure 5, Hise's map in Figure 6 (source: The Nature Conservancy) shows areas where wind farms might be appropriately sited. These are places with good wind resources and a projected low impact regarding wildlife conservation. In effect, the two maps are nearly inverse versions of one another. The newer map is the sort of GIS product that Jim Hays describes in his AWWI presentation.

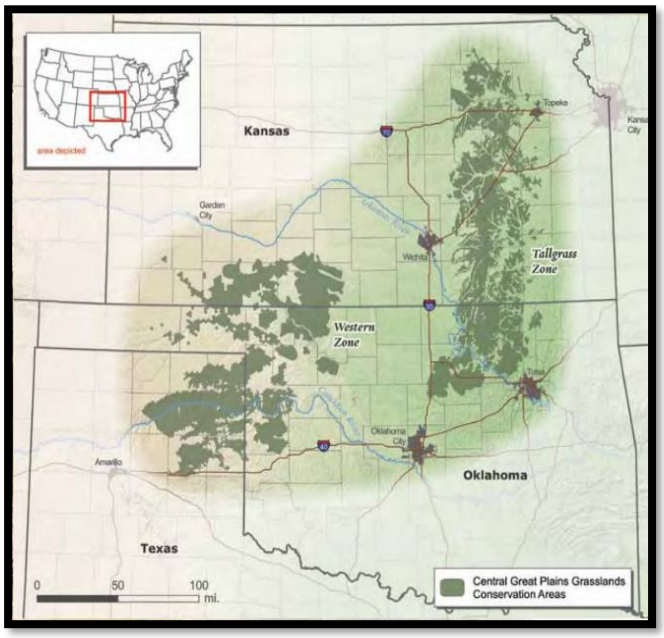

Figure 5: Central Great Plains Grasslands Conservation Areas 2013 (Source: The Nature Conservancy)

The map in Figure 6 appears in an undated brochure, published around 2015 by the Oklahoma TNC chapter, titled *Wind Energy & Wildlife: Site It Right,* and identified as part of the Central Great Plains Grasslands program. The brochure's subtitle reads: "Benefits for companies purchasing wind energy, wind energy developers and financiers, consumers, and wildlife." Within the brochure is reinforcing language explaining that the Site It Right initiative's intent is to help "utility companies and other power purchasers acquiring wind-generated electricity from the Great Plains [to] meet their renewable energy objectives while protecting nature by selecting projects sited in low-risk wind energy development areas." There is also a checklist of all the potential benefits of using the low-risk map (and associated database), as well as a description of the ways in which "companies can participate" in the drive to use low-risk wind development areas. These include:

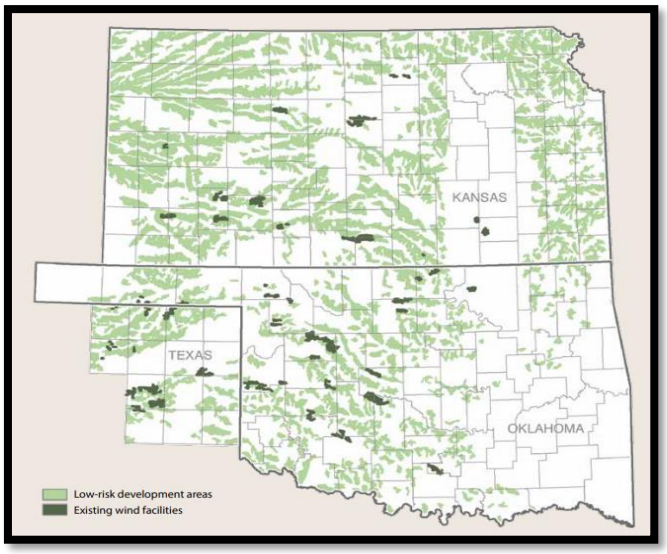

Figure 6: Proposed low-risk wind development areas for Kansas, Oklahoma, and the Texas panhandle (circa 2015) (Source: The Nature Conservancy).

- incorporating information in their RFPs and selection process indicating that ecological considerations will be taken into account when making selections;

- analyzing the locations of submitted/proposed facilities in comparison to the low-risk wind development areas map;

- utilizing the detailed maps of potential wildlife conflicts to formulate questions to be asked of developers regarding submitted projects (e.g. questions about awareness of issues, mitigation provided, agency agreements acquired, etc.);

- utilizing the low-risk wind development areas maps to discuss incorporation of these factors into approval processes for utility rates, company external communications, answering questions from customers or stakeholders, and sustainability reports.[38]

At the same time that the Central Great Plains initiative was underway in Oklahoma, Kansas and the Texas panhandle, important changes in organizational strategy were being made at The Nature Conservancy headquarters in Arlington, Virginia. The changes were being made under the leadership of Mark Tercek, who served as TNC Chief Executive Officer from July 2008 to June 2019.

In a "State of the Conservancy" speech given to the TNC Volunteer Leadership Summit in June 2017, Tercek outlined the broad arc of those changes.

> [In] … 2012 … we began to talk about the Global Challenges Global Solutions framework– and intentionally shifted from protecting nature one place at a time to tackling global challenges…
>
> We began to use the framework: protect, transform, and inspire to describe our work. Yes, we protect the world's great places and the planet's precious ecosystems—we've always done that and we always will. But to have greater impact, we also seek to transform how businesses, governments, and society use nature. That [is,] let us scale up. And we want to inspire more people to be constituents for nature.

Tercek went on to describe a number of changes associated with the new framework, including an intention to work across internal divisions.

> [We] … started ramping up our internal collaboration—across chapters and across our professional team and trustees. One great example is our work along the Mississippi River, aimed at dramatically improving agricultural practices. Here, our chapters and trustees work together on a regional basis, transcending traditional organizational structures and introducing new ways for the TNC team to get important work done.

> We began to think about how our professional team works together, too. In the past, many of our teams, at least to some degree, worked in siloes. Today, we need to collaborate at a much more sophisticated level across all units and all geographies to address the complex challenges we face. We're building training programs and investing in information systems to make that happen.
>
> As a science-based organization, we also took a hard look at the science behind our work. First up was Conservation by Design (CbD), TNC's toolkit for how to go about protecting nature. CbD had been based on a traditional model: protecting nature one place at a time. It served us and the broad conservation movement very well. But as the threats to our mission have changed, we've changed, too. CbD 2.0 now guides us in solving global problems—at a system-wide scale—and keeps people in mind as well.[39]

The CbD 2.0 conservation approach to which Tercek refers was actually approved by the TNC Board of Directors in February 2015. A "Conservation by Design 2.0 Guidance Document" (Version 1.0), dated March 2016, was shared both within and outside of TNC. A summary memo for "all Conservancy staff" provides information on the "key advances" incorporated in CbD 2.0, including the following.

> Explicit in CbD 2.0 is the expectation that conservationists increasingly seek to effect systemic change within the socio-ecological systems in which they work. Systemic change refers to creating, strengthening, or shifting the social, economic, political, and cultural systems that comprise and sustain a socioecological system. CbD 2.0 clarifies that the future of nature and the future of human civilization are interdependent. However, the major systems commonly used to describe the forces affecting that common future—economic, political, and social—do not adequately reflect this interdependence. In short, unless we act to address systemic causes, we are likely to fail in our mission.[40]

Site Wind Right

The new CbD 2.0 conservation approach coming from TNC headquarters strongly impacted the ongoing work to site wind farms on low-risk sites in the American Midwest. The strategy articulated as CbD 2.0 began was integrated into subsequent presentations on TNC's "Shared Conservation Agenda," which was referred to as "TNC's north star for conservation efforts."[41] The strategy was operationalized by headquarters through prioritization of projects that could be "scaled up" to engage TNC staff across states, divisions and professional disciplines. One such effort was the wind siting effort in Kansas and Oklahoma, whose name evolved from "Site It Right" to "Site Wind Right."

A key individual who crafted the re-energized push on siting wind resources in the Midwest was Sara Mascola, a graduate of Clemson University and former Peace Corps Volunteer in Peru, who earned her master's degree at Virginia Tech in Natural Resources and Global Sustainability Leadership. Having started at TNC headquarters in Arlington as a corporate engagement coordinator in February 2011, Mascola worked her way up by September 2014 to become a

program manager based in the Denver area for the Development by Design activities. Beginning in February 2016, she became a member of the "Global Energy and Infrastructure Team," as a program advisor, still working from her Denver base. One of the key members of TNC's Global Team to whom Mascola reported was Bruce McKenney, the policy expert who had co-authored the 2009 "Development by Design" paper with Joe Kiesecker.

By 2017, McKenney and Kiesecker were envisioning a world in which the public, private and non-profit sectors, as well as multi-lateral institutions such as the World Bank, would be collaboratively engaged in planning and creating a new energy infrastructure intended to address concerns of environmental and social risks as well as economic efficiency. Along with Linda Krueger, Graham Watkins and Amal-Lee Amin, McKenney co-authored an essay, titled "Policies, Practices, and Pathways for Sustainable Energy" that appears in a 2017 book, *Energy Sprawl Solutions,* co-edited by Joe Kiesecker and David Naugle. The essay sets out "a new road map for assessing synergies and trade-offs among multiple goals in energy development. Indeed, designing sustainable energy futures must be seen as a geographical process requiring integrated planning from national to local scales."[42] The maps and methodologies that Obermeyer and Hise, with guidance from Kiesecker and Fargione, had been developing for Kansas and Oklahoma over more than a decade enabled, in practice, the sort of scalable, geographically-based planning process that McKenney and his co-authors described.

McKenney and Rob McKim, a mentor to Mascola and director of TNC's Midwest Division based in Minneapolis, encouraged Mascola to take a look at the wind siting project. Both McKenney and McKim were intrigued by the possibility that the wind siting effort might have potential as a "scalable, shovel-ready" project.

In the summer of 2017, Mascola conducted interviews first with Rob Manes in Kansas and Mike Fuhr in Oklahoma, and then with the managers of TNC operations in 15 other midwestern states. She quickly confirmed McKenney and McKim's hunch, advancing the idea that the wind siting project did have considerable potential. She was particularly impressed with the "brilliance and personal humility" of Brian Obermeyer and Chris Hise, as well as the rest of the Kansas and Nebraska teams, who had managed to help break new ground on the issue without a great deal of fanfare. The teams appear to work with very little "personal ego" involved, noted Mascola. She saw that if the project were to scale up to cover 17 states, it would take more resources than the Kansas or Oklahoma chapters had on hand.

Mascola wrote a proposal to TNC leadership and chapter directors in the 17 states recommending a large, cooperative effort to gather information on potential biodiversity conflicts with wind, consolidate all of that information in a GIS system built by Chris Hise in Oklahoma, analyze the best way to communicate the findings, and make a concerted effort to listen and respond to the needs of electric power utilities, regulators, large corporate buyers and other key stakeholders.

The plan was adopted as proposed, with each state director contributing resources necessary in both person-hours and funds. Some states, such as Colorado and Wyoming, elected to join the effort even though they were not within the Central, or Great Plains division of TNC in the United States. The span of the initiative reached, on its North-South axis, from the Canadian border to Texas; and on the east-west axis, from Ohio to Montana. It spanned most of the Wind Belt, an estimated 80 percent of potential U.S. wind energy generation sites. Some fundraising was done from such sources as the MacArthur Foundation, which helped with early funding for a "listening tour," and the development of a communications and outreach strategy.

By the summer of 2018, more than 60 TNC staff members had contributed to the effort, working on one or several of the 60 technical reviews performed, and serving on one or several of the ongoing project committees. The committees were focused on data collection, scientific integration, communications strategy and outreach. By the second half of 2018, Mascola was readying herself for an assignment in India, transferring much of her work to Jessica Wilkinson. Mascola's job in the Midwest Division was finally filled in February 2019 by Nathan Cummins, a native of the St. Louis area. Cummings earned an undergraduate degree from DePauw University in Indiana and an MBA from Georgetown University in Washington, D.C. He then worked for the Obama Campaign in 2012, served as an intern in the President's Council on Environmental Quality, and worked for Lynn Scarlett's external affairs office at TNC headquarters in Arlington, Virginia. Cummins moved from the DC area to Minneapolis in January 2019 to take on the challenge, with the title of TNC Great Plains Renewable Energy Strategy Director.

Cummins worked with Jessica Wilkinson and Bruce McKenney to devise an ongoing strategy for Site Wind Right. Wilkinson, who holds a B.A. from Barnard College (the women's college affiliated with Columbia University), and a master's in Environmental Management from the Yale School of Forestry and Environmental Studies, joined The Nature Conservancy in 2012. She became TNC Senior Policy Advisor for Energy and Infrastructure in the North America Policy and Government Relations department, working in close collaboration with Bruce McKenney from her home base in Amherst, Massachusetts. She became deeply engaged in U.S. policy discussions regarding the impact of wind developments on wildlife, and was elected as a member of the Board of the American Wind Wildlife Institute in 2017.

Working as a team, Cummins, Wilkinson and Mike Fuhr (with support from Chris Hise) served as primary contacts for the roll-out in the United States of a white paper issued in July 2019: "Site Wind Right: Accelerating Clean, Low-Impact Wind Energy in the Central United States"(known at TNC as the "SWR Methods Paper").[43] If the 2015 Site It Right initiative focused on wind sites in Kansas, Oklahoma and the Texas Panhandle was "Version 1.0," the Site Wind Right maps in the July 2019 Methods paper covering 17 states was "Version 2.0."

The Site Wind Right analysis got considerable press coverage both within The Nature Conservancy publications, as well as in midwestern newspapers, selected university-related publications and conservation-oriented media. The key findings of the analysis were, in these various outlets, graphically illustrated with a series of maps that covered the wind belt states.

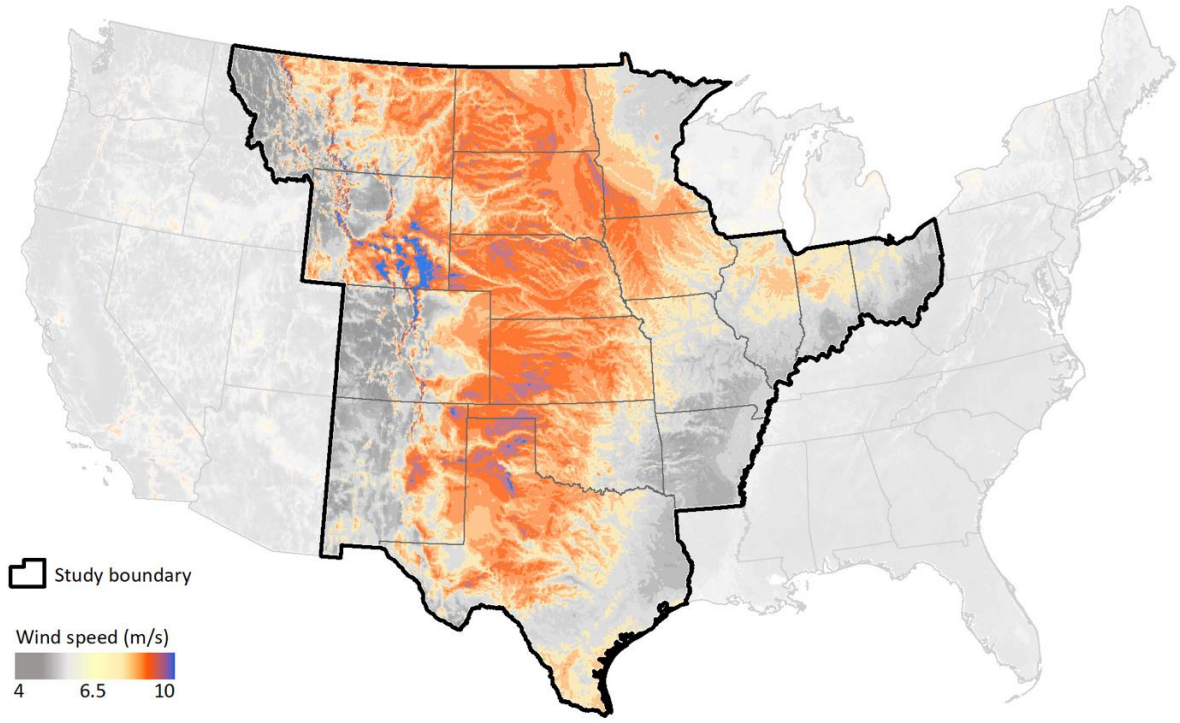

Figure 7: Site Wind Right Map of the Central U.S. Wind Belt (Source: The Nature Conservancy)

First, the analysis shows with some specificity where the best wind resources in the center of the country are located. As can be seen in Figure 7, the wind resources available leave a broad path through the Great Plains from Texas to North Dakota and Montana. Note that the resource data for this map was modified from a dataset dating from 2010 provided by AWS Truepower, which is now part of UL LLC.

Second, the analysis illustrates where potential biodiversity conflicts exist across the same 17 states, including color-coded indications of potential conflicts with: whooping cranes, eagles, high waterfowl breeding density sites, bat roosts, other threatened and endangered species, big game, important wetlands and rivers, protected and managed lands, intact natural habitats, and other sites with significant biodiversity resources. These maps are the product of the intensive work put in by dozens of TNC staff members, working in collaboration with wildlife experts at state and federal agencies, non-profit organizations, colleges and universities engaged in the data collection and technical review process (see Figure 8).

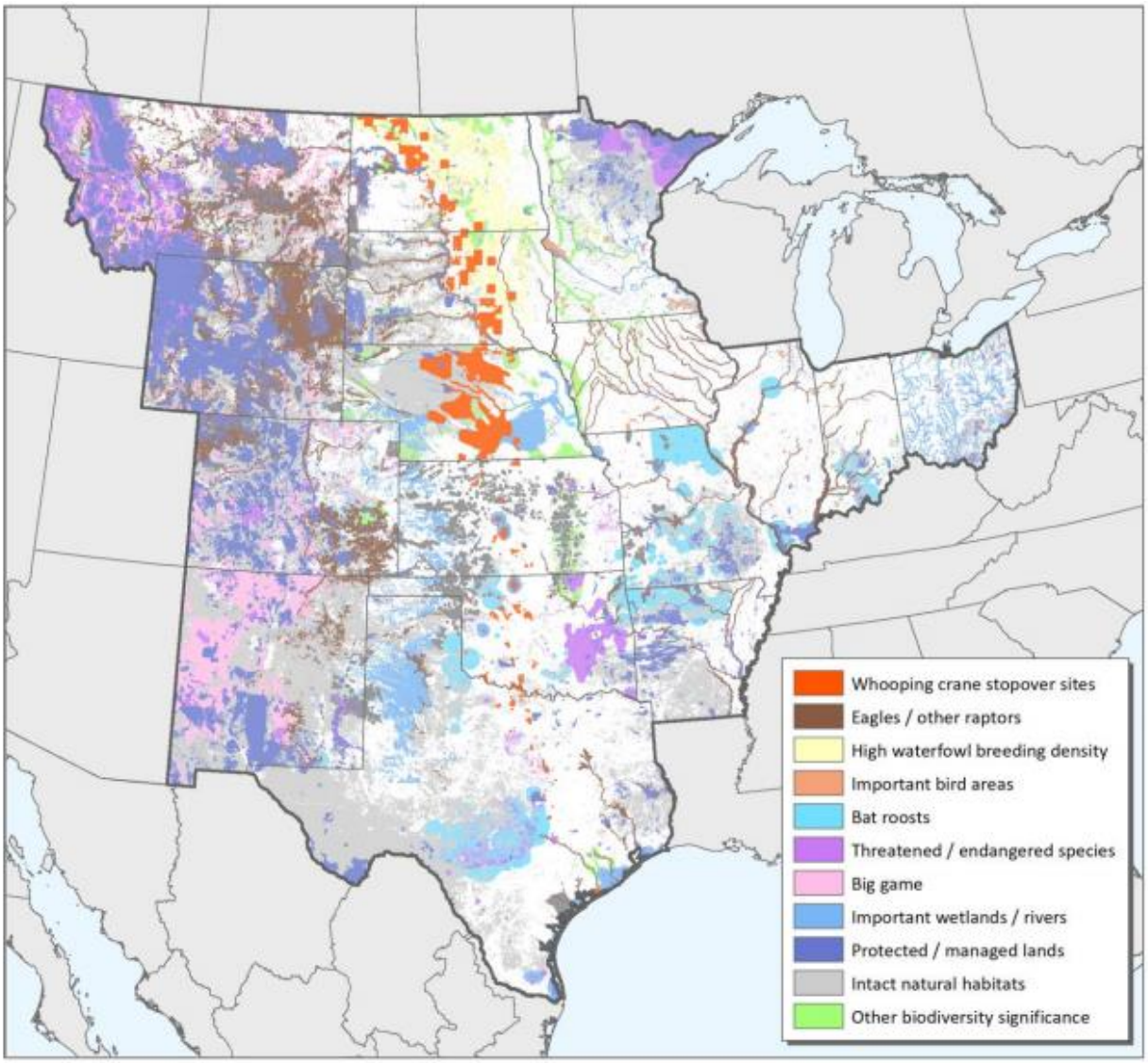

Figure 8: Site Wind Right Wildlife Layer (Source: The Nature Conservancy)

Third, the analysis offers complementary data on sites in which there are engineering and land use restrictions that limit wind farm construction. Such sites include airfields; special use airspace; radar stations; developed areas; existing wind facilities; areas with excessive slope, water and wetlands; poor wind resources; negative relative elevation; and statutory setbacks (see Figure 9).

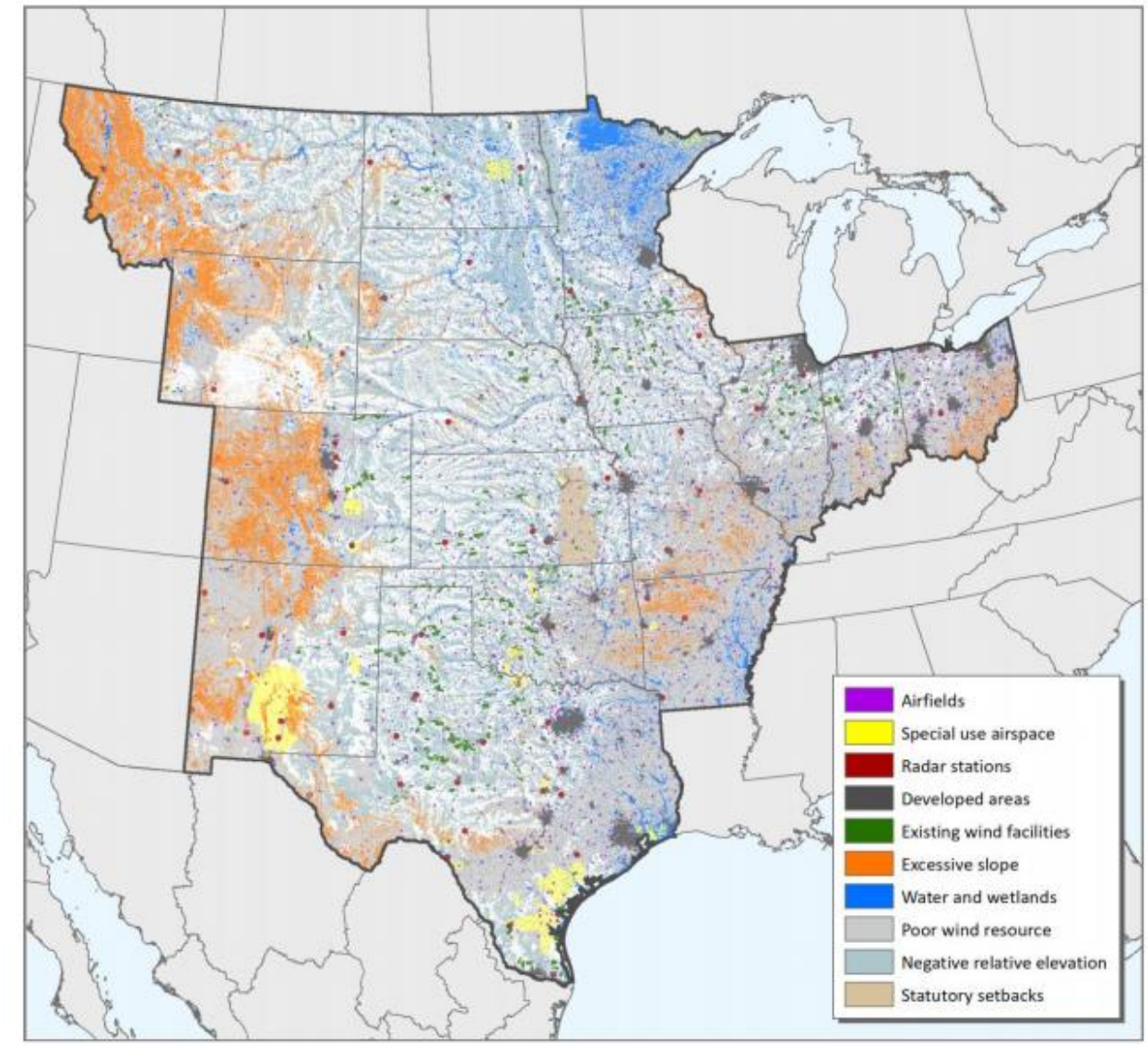

Figure 9: Site Wind Right Map of potential engineering and land use restrictions (Source: The Nature Conservancy)

Fourth and finally, the analysis allows the display of sites for wind power that are likely to have: suitable wind resources; expected low-impact on biodiversity resources; and low levels of potential conflict with engineering and land use restrictions. It is these remaining "suitable, low-impact" sites that are likely to be the most favorable sites for the development of wind resources (see Figure 10).

Pooled together across 17 states, the available suitable low-impact land totals to some 36.6 million acres, offering wind power capacity[44] of 1,099 Gigawatts (GW), which can be rounded to 1.1 Terawatts (TW). This is a very large potential, "more than 10 times current wind capacity and equivalent to the total [nameplate] generating capacity from *all* sources."[45]

Figure 10: Site Wind Right Map of Low-Impact Development Areas (Source: The Nature Conservancy)

It is important to note that the availability of suitable, low-impact land varies widely from state to state in the 17 state area, from 5.9 million acres in Texas to zero in Arkansas.

The Site Wind Right maps are intended to complement the voluntary, land-based Wind Energy Guidelines (WEGs) worked out over four years by a USFWS advisory committee in which TNC personnel, including Rob Manes, participated. As noted by the authors of the Site Wind Right 2019 methods paper: "The Nature Conservancy's Site Wind Right map was designed to serve as an important source of information to support screening early in the project siting process. It can be used to inform application of the WEGs, specifically Tier 1 and Tier 2 evaluations. The map is not a 'go/ no-go map…' The map can be used as one source of information to inform Tier 1/Tier 2 analyses, but it should not be the only source of information used. It was not intended to be used as a substitute for the WEGs, but rather used in conjunction with other appropriate information on habitat and species."[46]

Results to Date

Multi-Sectoral Enthusiasm for Site Wind Right

The initial response to the release of the Site Wind Right map and data tools has been positive in a number of instances. Positive responses and favorable publicity have come from sources in the academic, public, non-profit, and private sectors.

With regard to the academic sector, the Spring 2020 edition of *Living Bird*, a print and online publication of the Cornell Laboratory of Ornithology, gave Site Wind Right favorable treatment in its article on the challenges facing prairie chicken populations in the Flint Hills. The article points to the encouraging findings of the Site Wind Right analyses in Kansas, telling the story in part from Brian Obermeyer's perspective.[47]

> "The Nature Conservancy, from the very beginning, made it very clear we were supportive of wind power," says Obermeyer. "This is just an effort to help siting in a way that avoids key habitats."
>
> The Conservancy crew puzzled over how to mitigate the effects of wind farms on areas they identified as ecologically valuable, such as large tracts of native prairie or playas.
>
> "What we found was that there are some places you just can't [mitigate wind-farm effects]…they're irreplaceable," says Obermeyer. "You cannot recreate an intact native grassland. You just can't mitigate that."
>
> But by looking at maps, they realized Kansas had more than 6 million acres of thoroughly roaded and plowed farmland, largely to the west of the Flint Hills where wind development would pose little additional threat to wildlife and rare ecosystems. That's enough for 134 gigawatts of installed wind capacity, roughly equivalent to 100 conventional power plants—far more than even the most optimistic forecasts for state wind production.

In the private sector, the initiative has been favorably treated by some utilities and large corporate power purchasers. Evergy, an important midwestern utility, praised Site Wind Right as noted in *Power Magazine*, in its July 27, 2020 edition:

> Evergy, headquartered in Topeka, Kansas, and Kansas City, Missouri, is among the utilities utilizing the analysis to develop its wind power projects. The investor-owned utility, created by the merger of Westar Energy and Kansas City Power & Light in 2018, earlier this year announced it would add 660 MW of wind power to its portfolio, utilizing four new wind energy sites as an incentive to retain and attract large commercial and industrial power users in its service territory….
>
> Terry Bassham, Evergy's CEO, said, 'Site Wind Right is an invaluable resource that helps us avoid unnecessary impacts to the wildlife and iconic landscapes of the Great Plains,

> while also allowing us to provide clean, low-carbon energy for our customers.' Evergy in January of this year announced a commitment to achieve an 80 percent reduction in carbon dioxide emissions below 2005 levels from its fleet of power plants by 2050."[48]

Salesforce, the giant corporate software provider, has cited Site Wind Right as a useful tool for analyzing the wildlife habitat impact of proposed wind energy projects. The authors of Salesforce publication "More than a Megawatt" recommend in the Land Use section of the paper that renewable power developers and purchasers make efforts "to incentivize contracting with generation and storage projects in the built environment and on modified lands, while disincentivizing contracting with projects in critical or natural habitats." Guidance offered in the report for corporate power purchaser requests for proposals (RFPs) in the United States suggests that developers ask their staff and consultants the following question: "Have you consulted with federal and state agencies with trust responsibilities over wildlife to incorporate relevant science-based recommendations, data, and information (e.g., state wildlife action plans and planning tools, such as The Nature Conservancy's Site Wind Right Map)?"[49] The "More than a Megawatt" report has had an impact well beyond Salesforce itself. For example, the Renewable Energy Buyers Alliance (REBA) and its REBA Institute, which engage corporate electricity procurement representatives from more than 60 large corporations, has spotlighted the effort: "the REBA Institute is grateful to Salesforce for funding and their grounding work on More than a Megawatt…"[50]

Representatives of the public sector also offered praise for the work of the creators of Site Wind Right. On September 19, 2019, the Association of Fish and Wildlife Agencies, whose officers are all associated with state fish, wildlife, conservation and natural resources agencies, awarded Chris Hise and Brian Obermeyer a Climate Adaptation Leadership Award for Natural Resources in the Non-Governmental Organization category. The award recognizes "exemplary leadership by individuals, agencies, businesses and other organizations to reduce impacts and advance adaptation of the nation's vital natural resources and the many people who depend on them in a changing world." Chris Hise, in commenting on the award, noted that "the Site Wind Right project was truly a team effort, with contributions from conservancy scientists and GIS staff across the central U.S."[51]

In addition, non-profit organizations pushing for deployment of renewable technologies joined in to praise Site Wind Right. Katie Umekubo, a senior attorney with the Natural Resources Defense Council (NRDC), enthusiastically reported that "we need more resources like this to speed-up our move away from burning fossil fuels. Well-sited wind energy allows us to meet our climate goals, advances conservation, and ensures that we avoid irreversible environmental impacts." [52] Garry George of the National Audubon Society was similarly supportive, stating: "climate change is the biggest threat to birds… As we work to keep warming below 2.7 degrees Fahrenheit (1.5 degrees Celsius), we also need to protect the places that birds need now and in the future. Site Wind Rite is a valuable map filled with conservation data for developers to use to evaluate where to site their projects to protect birds and reduce warming."[53]

Significantly, some private landowners in Kansas and Oklahoma have expressed their support for Site Wind Right. Oklahoma Rancher Ford Drummond and his father Fred have emphasized the need for balancing energy development and wildlife concerns. Ford is emphatic:

> We need renewable energy in this country. It's an opportunity for clean power. But for everything there is a right and a wrong place, and the last remaining four percent of our nation's tallgrass prairie is not the right place for wind turbines…
>
> We used to have a bald eagle nest on our land. Not anymore…
>
> I am a strong supporter of Site Wind Right. I think if it had been available earlier, we would have had a better outcome for my ranch and the tallgrass prairie. [54]

And, of course, there is Jim Hoy, the eloquent master of the local vernacular who grew up on a Flint Hills ranch and became a beloved Professor of English at Emporia State University. Hoy, who has maintained his support for careful siting of wind power in Kansas over nearly two decades, wrote as far back as 2002, that … "I'm not opposed to alternative energy sources. In fact, I think that we should be, and all along should have been, doing a lot more to supplement our petroleum energy supply with solar, wind, and water power… It seems to me, however, that there's a right way and a wrong way to go about this process, and the right way is not to trash the most beautiful landscape in Kansas."[55]

When asked in early 2021 if he thought Site Wind Right was a good approach, Hoy, now a Professor Emeritus at Emporia State, responded enthusiastically:

> I am so much in favor of what TNC is doing with Site Wind Right. Petroleum will not last forever. The wind, though, is never going to quit in Kansas. And there are so many places that don't have the beauty of the Flint Hills that are really better sites for wind farms.[56]

Hoy has made clear his support for Kansas Governor Laura Kelly's July 28, 2020 extension of the moratorium on wind facility development in the Flint Hills. In the fall of 2020, Hoy wrote an editorial for the *Kansas Reflector* reiterating his passion for the prairie:

> The Flint Hills of Kansas are a national treasure. It's a treasure unfortunately invisible to many… But the beauty of the Flint Hills is calming, reassuring. There are no hairpin turns here, no steep sided mountain passes that turn an automobile driver's knuckles white. Instead, as the late Matfield Green rancher Wayne Rogler once told me, your pulse rate is guaranteed to slow down whenever you are out in the middle of a Flint Hills pasture…
>
> All of the above is prelude to my expression of gratitude to Gov. Laura Kelly for reaffirming a moratorium on wind development in the Tallgrass Heartland, an area that includes parts of 12 Flint Hills counties…
>
> Thank you, governor. [57]

International Developments

The Site Wind Right ideas and methodologies developed in the Great Plains have been shared across the United States and around the globe, to serve as an example of interest. Conversations about how to further develop or independently improvise informed by these ideas have taken place from South America to Asia. Two places in which the methodology has proved to be particularly useful and interesting are India and China.

India

With the support of many of her TNC colleagues and supervisors, including Bruce McKenney, Sara Mascola was offered, in the second half of 2018, the opportunity to serve as an India program advisor. She and her husband moved to New Delhi, where she worked from November of 2018 to September 2020 to support "the expansion and implementation of the India Program." Mascola "assisted in the development and implementation of new projects, advised the management team, and supported projects within the Lands conservation strategy portfolio."[58]

One of the initiatives she helped to advance is named SiteRight, an effort managed by Dhaval Negandhi, an ecological economist with TNC India. SiteRight has been supported by the Vasudha Foundation, the Center for Science, Technology & Policy (CSTEP), and the Foundation for Ecological Security in India, as well as the MacArthur Foundation. It is informed by an analysis of land use scenarios associated with renewable energy deployment, and builds on the concept that "developing energy on lands degraded by human activities rather than placing new infrastructure within natural habitats or areas of high production agriculture would reduce cumulative impacts and minimize land use conflicts."[59]

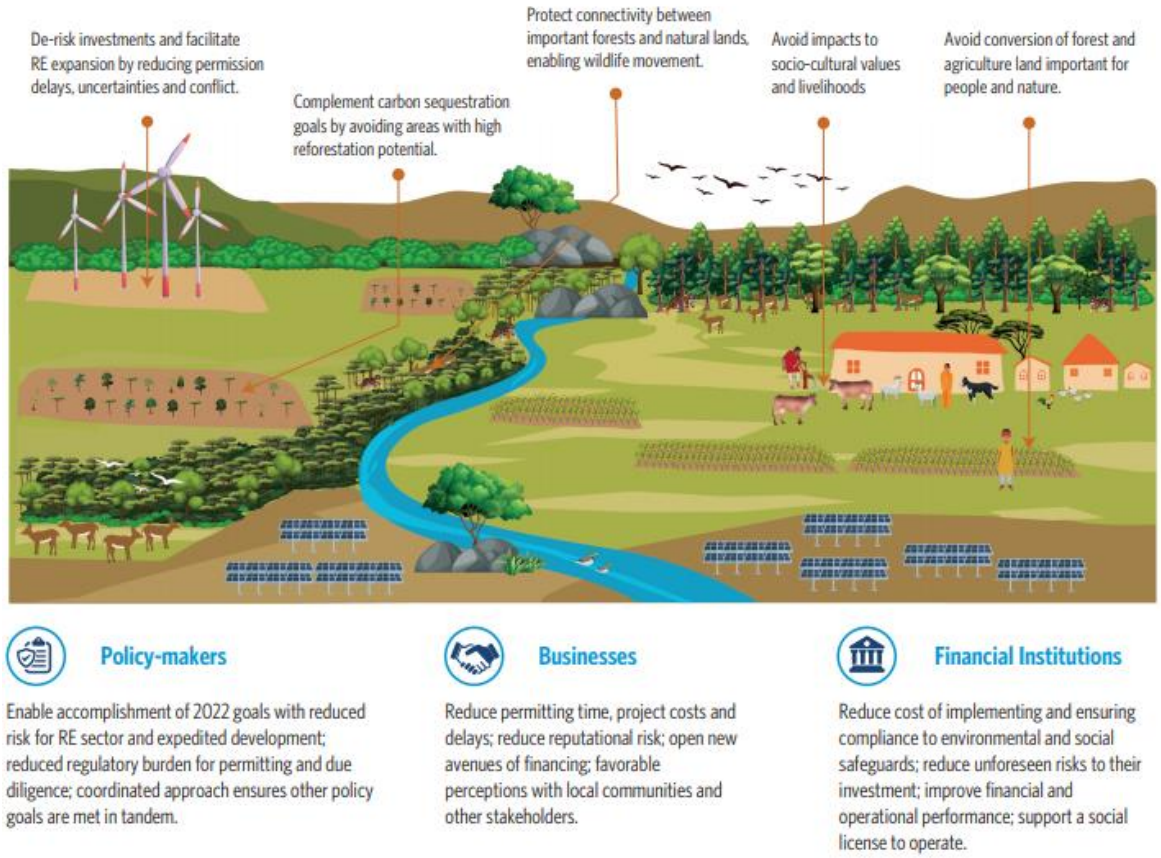

Figure 11: Benefits of Lower Impact Siting Associated with SiteRight in India. (Source: The Nature Conservancy)

The SiteRight tool was created to identify areas where solar and wind development is less likely to encounter socio-ecological conflicts, thereby helping to reduce project delays and cost overruns. Developed now for the states of Madhya Pradesh and Maharashtra, the tool will be expanded to all states with large solar and wind energy potential in the future.

Designed to assist policy-makers, businesses and financial institutions, SiteRight "has three modules to support siting decisions in various contexts: Awareness, Site Assessment and Planning (see Figure 11).

It is cited by the World Economic Forum in its "New Nature Economy Report III" as a tool which "combines GIS maps and data from about 100 databases. Its use by private developers, financial institutions and state governments could "allow India to meet its sustainable development goals, [and allow] businesses and investors to manage their risk exposure and costs associated with negatively impacting nature and people." [60]

Dhaval Negandhi explains the value of SiteRight in a July 2020 interview *in The Bastion*, an Indian digital magazine:

> The good news in terms of emerging conflicts due to large renewable projects is that if we take steps today to guide the growth of renewables to areas with lower ecological impact, we can develop more than enough RE [renewable energy] – greater than 10 times our 2022 capacity goal. In that context, these partners have collaborated to reduce socio-environmental risks for the RE sector.
>
> SiteRight aims to facilitate the rapid expansion of RE while ensuring minimal harm to places important for nature and people through lower impact siting. It can be used by policymakers, businesses, and financial institutions to not just identify socio-environmental risks to sites already identified for RE projects, but to also identify alternate sites for projects with viable solar and wind energy potential but lower socio-environmental impacts.[61]

China

Work is also ongoing in China to use planning methodologies similar to those use in the Site Wind Right effort to achieve "a balanced spatial layout" that meets Chinese planning objectives for both biodiversity conservation and renewable energy development. As in India, this effort is informed by the work done by Joe Kiesecker, Joe Fargione, and colleagues on renewable energy siting. In addition, two other TNC staff members from the United States, Mark Lambrides and Amy Newsock, visited China to present Site Wind Right research results at a China Wind Energy Association conference held prior to 2020 and 2021 travel curtailments related to the COVID-19 pandemic.

In an early 2020 presentation hosted by TNC China and the Energy Research Institute of the National Development and Reform Commission of China, Luo Yongmei of TNC China offers a nationwide analysis of the areas with favorable renewable energy resources (horizontal annual solar radiation and wind power density). She then contrasts those areas with areas that, because of biodiversity conservation priorities, should be considered "avoidance areas," "high-risk areas," and "low-risk areas." Luo continues by looking at where solar and wind facilities had already been sited. She finds that 71 percent of wind facilities, and 85 percent of solar energy facilities, built to that time in China had been sited on low-risk lands. The presentation concludes by showing that available low-risk development areas available in 2020 appear to be sufficient to meet China's 2030 goals for renewable energy development, potentially eliminating the need to develop renewable energy facilities on "avoid" or "high-risk" lands.

The challenge ahead for Chinese decision makers, Luo states, is: "How to do a multi-objective spatial planning that balances China's goals for…] biodiversity and renewable energy?" Luo suggests that continued analysis along these lines may well indicate the optimal sites for nationwide renewable energy development, thereby achieving both renewable energy and conservation objectives.[62]

Bren School Analysis

In January 2018, a group of first year masters students from the Bren School of Environmental Science and Management at the University of California, Santa Barbara (UCSB) proposed a project to build a case "for Conservation-Compatible Renewable Energy Development in the U.S. Wind Belt." The project was launched in the spring semester of 2018, and Sara Mascola and Mike Fuhr at The Nature Conservancy signed a Letter of Support committing TNC to provide all necessary "guidance, available data, coordination, and technical review to the students," and to fund a summer internship for a Bren student "to do further research on wind development in the central U.S. in support of this project and our broader renewable energy strategy."[63]

Hanna Buechi, a native of the San Francisco Bay area in California, served as the summer intern. Buechi and her student collaborators Alex Irvin, Delaney Roney, Margaux Sleckman and Cristina Sparks, with guidance from Bren School faculty Sarah E. Anderson and Kyle C. Meng, focused on the following research questions: 1) Do wind projects in low-risk areas have a lower likelihood of being cancelled? and 2) Are there other factors, such as negative publicity, that predict the likelihood of cancellation?

In their final report, issued in Spring 2019, the students identified, using a wind industry database, a group of 868 wind farm projects as of November 2018 that had either been completed or cancelled in the 17 states considered in the Site Wind Right map. Of that group, only 298 (about 34 percent, or about one-third of the total) were located in Site Wind Right low-risk areas; the balance, 570 projects (about 66 percent, or two-thirds of the total), were in areas identified as having high risks of conflict with conservation values. The fact that only one-third of the projects were in low-risk areas cannot fairly be associated with the influence (or lack of influence) of the Site Wind Right maps for the 17-state region, as those maps were not widely released to the public until July 2019, after the Bren School student analysis was completed. What the project distribution data does indicate is that The Nature Conservancy and its partners have considerable work ahead to encourage most wind developers in the U S wind belt to site their projects in low-risk areas.

Using logistic regression modelling[64] to examine development outcomes for the 868 projects (of which 473 were completed, and 395 were cancelled), the Bren School team determined, in answering their first question, that projects located in low-risk areas "are 50 percent less likely to be cancelled" than projects located in high-risk locations.

Addressing their second question, the student team determined that wind projects having positive publicity (as determined using an analysis of selected key words appearing in project press coverage) are likely to be cancelled.

Combining the two factors of project location and publicity score, the team determined that projects with both low-risk locations and more positive publicity scores had only a 30 percent probability of cancellation. Conversely, projects with high-risk locations and more negative publicity scores had a 55 percent probability of cancellation.

In most cases, cancelled projects obviously result in financial losses to their developers. Conversely, completed projects typically provide financial gains to their developers. Developers with higher project completion levels are much more likely to have higher total annual financial returns, and therefore be enabled to identify new sources of financial capital to move forward to develop additional projects.

Given these results, the Bren School team offered three conclusions:

- Developers should locate projects in low-risk areas to reduce the likelihood of cancellation.

- Communities and conservation organizations can influence siting through publicity.

- The Nature Conservancy should market Site Wind Right to help developers avoid project cancellation. [65]

By mid-2019 Site Wind Right had offered the land and biodiversity conservation community an opportunity to work together with renewable energy developers, utilities, state regulators and citizens of the Great Plains and Central United States to achieve a long dreamed-of goal – to balance conservation and development. To paraphrase an aphorism that is sometimes attributed to Benjamin Franklin, Site Wind Right showed a way that the people of the Great Plains could "do good and do well." [66] Analysis and remarkably detailed maps produced by The Nature Conservancy demonstrated that plenty of wind capacity, likely to yield profitable financial returns, could be sited on low-risk sites with relatively few biodiversity conflicts.

However, demonstrating that such a goal is achievable is not the last step in directing wind development to low-risk sites. Progress had indeed been made by 2019 with utilities such as Evergy, with the succession of Kansas governors who had placed moratoria on wind development in the Flint Hills, and with other policymakers. Still, as wind capacity development continues to ramp up (see Box 1), substantial present and future risks posed by existing and future wind energy developments, as well as the development of other forms of renewable energy, remain for wildlife. Site Wind Right has been instrumental in raising the visibility and significance of this issue, putting it "on the map" of conservationists, developers, regulators, elected politicians, and citizens. In terms of mitigating the impact of renewable energy development on biodiversity, the question for conservationists in the 2020s is: What comes next?

Box 1: Recent and Forecast Growth of Wind Power Installations in the United States

To get an idea of the growth and size of the installed base of wind power facilities being considered, note that US installed capacity in the year 2000 was less than 2,000 megawatts, and has grown to more than 122,000 megawatts by 2020. That is an expansion of more than 60 times capacity over the span of twenty years (see table below). Bloomberg New Energy Finance[67] in October 2020 projects wind continuing to grow at a rate of 5.7% globally through 2050. Assuming that this global rate applies to the US installed base in 2020, there would be some 212,000 MW of wind capacity installed in the US by 2030, and about 644,000 MW installed by 2050 – over the next 30 years, that is an amount more than five times the cumulative installed Megawatts recorded in 2020. As large as that may seem, it is still within the Terawatt of additional capacity that TNC analysts believe can be suitably developed on low-risk sites across the 17 states considered in the Site Wind Right analysis.

For at least part of that period until 2050, development of wind energy capacity is likely to continue to be concentrated in the US wind belt in the Great Plains, where the best wind resources exist. American Clean Power reports for the year including the fourth quarter of 2020, "the industry has added 90 projects across 26 states totaling 16,913 MW. Texas leads installations for the year (4,235 MW), followed by Iowa (1,498 MW) and Wyoming (1,123 MW)." More than 90 percent of the wind capacity added across the nation in 2020 was added within the 17 states covered by the Site Wind Right maps.

Historic Growth of Installed Wind Power Capacity in the United States from 2000 to 2020

Year	*2000*	*2005*	*2010*	*2015*	*2020*
Megawatts (MW) Wind [(i)]	x < 2,000	9,046	40,346	73,891	122,468
5 Year Growth Rate [(ii)]		x > 35%	34.8%	12.9%	10.6%

i) Cumulative US Wind Power Capacity Installations, in Megawatts[68]
ii) Compound Annual Growth Rate (CAGR) over preceding 5 years (e.g., CAGR from 2015 to 2000)

Additional and Subsequent Research

Power of Place

At about the same time that the Bren School team at UCSB was completing its analysis of Site Wind Right, another researcher affiliated with both The Nature Conservancy and UCSB, Grace C. Wu, who works closely with TNC California Energy Strategy Director Erica Brand, was preparing to release her team's analysis of the impact of renewable energy planning and siting practices in California and across a multi-state Western Regional landscape.

Wu has an impressive record as a student. After her first year at Pomona College in California, she had a summer internship at the Harvard Forest in 2005. She graduated in 2008 with a degree in biology from Pomona, with *Magna Cum Laude*, *Phi Beta Kappa* honors. She went on to earn an M.Phil. from Cambridge University in the UK in zoology in 2009, and an M.S. and Ph.D in Energy and Resources from the University of California at Berkeley in 2013 and 2018, respectively. During those years, she also found time to consult or work with the World Bank, the International Renewable Energy Agency, and the California Public Utilities Commission, among other organizations.[69]

Soon after earning her Ph.D., Wu was named by The Nature Conservancy as a David H. Smith Conservation Research Fellow, affiliated with the National Center for Ecological Analysis and Synthesis (NCEAS), located on the UCSB campus. In her Smith Fellows profile, "Class of 2018," Wu lists Joe Fargione of The Nature Conservancy as one of her two mentors, an indication that her research interests in some important ways overlap with his. In her profile on that page, she explains her research agenda going forward:

> Competition for land in an increasingly crowded world is leading to over-extraction of resources, biodiversity loss, climate change, and reduced climate resiliency. Meeting many sustainable development goals—climate change mitigation, energy for all, biodiversity preservation, and food for all—requires a way to reconcile and avoid land use conflicts. There are inherent trade-offs in land use decisions, and achieving consensus or compromise among diverse stakeholders requires a framework for quantifying these trade-offs and identifying optimal solutions. Such a cross-sector framework for land use is currently lacking. In collaboration with The Nature Conservancy and the Lawrence Berkeley National Laboratory, I propose to identify targets and develop a "backcasting" method for designing sustainable land use pathways for the United States that meet biodiversity, climate mitigation, and agricultural production goals by 2050. While forecasting predicts probable futures beginning with the present, backcasting begins with a vision of a desirable future and is primarily concerned with determining the best ways, or "pathways," to enable that future. The pathways themselves are combinations of policy, technology, or management decisions necessary to simultaneously achieve multiple land use goals.[70]

A detailed technical report on Wu's initial work was published in June 2019. At about the same time, a separate Executive Summary and press releases from The Nature Conservancy were also published.[71] The "Key Results" listed included several that emphasize the importance of **state-wide and regional planning processes** necessary to reach both renewable energy and biodiversity conservation goals by mid-century. The following three (of a total of eight findings offered) are illustrative.

> • With planning, California can significantly ramp up renewables and limit land impacts. Through proactive planning that incorporates conservation data, California can achieve deep decarbonization by 2050 under a high-electrification scenario while protecting important lands.
>
> • In the absence of a plan to limit land impacts and scale up renewables, impacts to natural and agricultural lands could be high. The study reveals that a large percentage of areas in the West with renewable resource potential have environmental or agricultural value. If siting protections are not applied, many of these lands could be selected for energy development.
>
> • Achieving the best conservation outcome is more cost effective at a regional scale. Costs of increased environmental siting protections are highest when resources available for development are limited to California. In the regional scenario…, the portfolio that protects high-conservation-value lands … is approximately 10 percent less expensive than the same level of protection in the California scenario.[72]

As such, these findings complement the Site Wind Right results, demonstrating that it is not only important to work with wind energy developers, utilities, and bulk purchasers to address issues related to the siting of individual wind energy sites; careful attention to state- and region-wide energy planning processes, and work with the planners, regulators and political decision makers is also critical. In effect, a holistic approach to renewable energy siting that has promise to become larger than the sum of its parts is emerging from the experience of TNC field practitioners and researchers in Kansas, Oklahoma and the Great Plains, in combination with the work of their colleagues in California and the West.

Clean and Green Pathways

Such a holistic approach is apparent in a publication authored by Bruce McKenney and Jessica Wilkinson in 2020. In the Introduction to the report, "Clean and Green Pathways for the Global Renewable Energy Buildout," [73] the authors frame the set of opportunities facing the diverse actors working to build out a renewable energy infrastructure, while protecting biological diversity at a national and a global scale. Note that the rationale is similar in many ways to that offered in various earlier publications focused on the Site Wind Right approach.

> The good news is that if we take steps today to guide the buildout of renewables to areas that are low impact for nature, we can develop more than enough low-carbon energy for

> a clean and green future. We do not need to trade impacts to natural lands for renewable energy development. [In addition to] … reducing energy demand through energy efficiency, making grid upgrades, and increasing distributed renewable energy generation [, we] will also need to promote the buildout of utility-scale solar and wind energy in places that are low impact for nature and supported by local communities.
>
> Fortunately, the world has more than enough low-impact areas—lands that have already been significantly altered for agriculture, infrastructure, and other development activities—that also have high renewable energy development potential." [74]

In the report, McKenney and Wilkinson describe six different pathways for driving renewable energy development to low-impact areas: the first four primarily engage the public sector; the next two are primarily focused on private sector initiative. The six pathways and a description of the opportunities each represents follows below.

PUBLIC SECTOR PATHWAYS

1. Renewable Energy Zones: identify and approve low-impact zones for renewable energy development, in advance, to support faster project approval.

2. Planning and Procurement Processes: direct renewable energy projects to low-impact areas through long-term planning and purchasing processes.

3. Guidelines for Project Siting and Design: establish renewable energy siting and design guidelines to support low-impact projects

4. Programs to Promote Projects on Contaminated and Degraded Lands: incentivize renewable energy projects on contaminated and degraded sites suitable for development

PRIVATE SECTOR PATHWAYS

5. Corporate Procurement and Sustainability Commitments: commit to low-impact renewable energy in corporate buyers' principles, procurement guidance, and criteria for project selection.

6. Renewable Energy Finance: ensure lending performance standards, due diligence processes, and technical assistance support low-impact renewable energy projects.

Note that Pathways 1, 2 and 4 employ regional planning strategies to identify suitable sites for renewable energy development, similar to the planning protocols employed in the "Power of Place" study led by Grace Wu.[75] Pathways 3 and 5 build on work associated with the Site Wind Right team, including:

- use of the USFWS's Wind Energy Guidelines, which reflects the input of an Advisory Council on which Rob Manes of TNC served;

- use of the Site Wind Right Maps, which are a featured example described in the *Clean and Green* report,[76] and;

- leveraging corporate procurement and sustainability commitments in renewable energy site planning, reflecting the work of Nathan Cummins, Bruce McKenney, Erica Brand, and Jessica Wilkinson with the members with the authors of the Salesforce publication "More than a Megawatt," and with the Renewable Energy Buyer's Alliance.

IUCN Report: Mitigating impacts in renewable energy projects: Guidelines for developers

The interest in sustainable siting of renewable power projects, as noted above in sections on India and China, has been a topic of sustained international focus. Learning has accumulated from wide variety of efforts in many corners of the globe focused on this topic. For example, the European Union and Birdlife Europe have engaged in research and knowledge exchange on the topic for more than a decade. Recently, the International Union for the Conservation of Nature (IUCN) convened a team to report on the subject, principally funded by two European electric utilities and an international oil company (Électricité de France (EDF), Energias de Portugal (EDP) and Shell), with core support for the IUCN from government agencies in Denmark, Finland, France, Korea, Norway, Sweden, Switzerland, and the United States. As explained in a brief description of the report on the IUCN website:

> "Clean energy sources" like solar and wind can also impact biodiversity through disturbance and loss of habitat, the generation of noise pollution, collision and other indirect pressures. Therefore, despite the intrinsic and much-needed positive contribution of these renewable technologies to a clean energy future, renewable energy developments need to address the associated risks to biodiversity, throughout the entire project life cycle -- from design and permitting to the operational and decommissioning phases.
>
> As a result of a collaborative process that began in 2019 between IUCN, EDF, EDP and Shell, IUCN, along with The Biodiversity Consultancy, have produced a report, "Mitigating the biodiversity impacts associated with solar and wind energy development: Guidelines for project developers." The report draws on expertise from the three energy companies as well as BirdLife International, Fauna & Flora International, The Nature Conservancy and Wildlife Conservation Society.[77]

The Guidelines were designed to "serve as an integrated and practical reference source that presents good practice approaches to manage impacts on biodiversity and ecosystem services.[78] As such, it offers details on some 33 case studies,[79] following detailed recommendations regarding guidelines for mitigating the impact of wind and solar projects. One case study features Site Wind Right and another "Power of Place." Both of these cases were provided to the

IUCN team by TNC's Joe Kiesecker. Furthermore, the mitigation hierarchy on which the IUCN study is based follows many of the same lines as those followed by Kiesecker and Fargione in earlier studies. In sum, the early work done by the TNC team on Design by Development strategies in general, and on Site Wind Right and "Power of Place" in particular, inform the approach taken by the IUCN report authors.

Moving Ahead

The rapid growth of wind and solar energy capacity in the U.S. and worldwide is expected to continue between 2020 and 2050. As strong as wind capacity growth may be, the growth in solar photovoltaic capacity deployment may be even stronger. According to Statista, the cumulative installed base of photovoltaic systems in the United States grew from about 3 GW in 2010 to more than 60 GW in 2019, representing a compound annual growth rate of greater than 39 percent. [80] Offering evidence that there will be strong growth ahead, investment analysis firm Wood Mackenzie reported in January 2021:

> The cost of solar power has dropped 90 percent over the last two decades, and will likely fall another 15 percent to 25 percent in the decade to come… By 2030, solar will become the cheapest source of new power in every U.S. state, plus Canada, China, and 14 other nations.
>
> As the world strives to recover from the economic slump caused by the Covid-19 pandemic, and simultaneously meet the climate and environmental goals of the Paris Agreement, solar is uniquely placed to advance efforts towards a low-carbon, sustainable future.
>
> Solar is already the cheapest form of new electricity generation in 16 U.S. states, plus Spain, Italy and India. Even with the Covid-19 pandemic raging, global installations exceeded 115 GW in 2020, compared to 1.5 GW in 2006.[81]

Given the strong growth and significance of each technology, the next iterations of the Site Wind Right methodology for the U.S. to be released by TNC are likely to include analyses relevant to both wind and solar technologies. These "Site Renewables Right" maps will first be prepared for a total of 19 states (the 17 states covered by the earlier version of Site Wind Right, plus Michigan and Wisconsin). Subsequent versions will likely cover all 50 of the United States, given the potential for growth across the North American continent.

Lessons Learned

- Building the organizational focus, field support, donor interest, scientific expertise and GIS capacity to accurately and accessibly map high-risk and low-risk sites for wind (and solar) facility sites takes time, patience, and a broad diversity of individuals, from Kansas ranchers to global organizations such as the IUCN. In the Site Wind Right case, that suite of conditions has been building upon itself for about two decades within and beyond The Nature Conservancy. That process continues today.

- The capacity to identify low-risk sites for wind, and to demonstrate that there is an ample number of sites to address national demand across the central United States is a good start. It is, however, only one part of a necessarily more holistic approach to driving the development of renewable energy development to sites in which there is little or no conflict with biodiversity. The design and implementation of a more holistic approach will require planning expertise and capacity, and both political and business-sector knowledge and agility, among other toolsets and skills.

- The audience for this approach to energy siting will also be broadly diverse, including public sector and private sector decision makers that determine where new renewable energy facilities will be sited. Such individuals will be comprised, in the public sector, of legislators, regulators, public-sector energy and environmental program administrators, land use planners and citizens. In the private sector, key audiences will include project developers, utility executives and planners, and corporate buyers.

- The use of such a holistic approach to renewable energy siting will be relevant not only in the United States, but rather on a global basis. A global approach, which considers learning across Europe and South America, will be necessary to address the potential threats to biodiversity that may otherwise occur.

- Siting sufficient renewable energy capacity to address the climate change crisis while avoiding conflicts with biodiversity will necessarily take a focus on a wide variety of landscapes and waterscapes, from coastal wetlands and offshore development zones, to working forests and agricultural sites.

Policy Recommendations

- At the local level, advocates for siting renewable energy facilities in low-risk areas have an opportunity to work with: town, municipal and county permitting and land use planning authorities to advance science-based siting regulations and their implementation; developers, utilities and transmission companies that are potential builders, buyers and carriers of renewable energy; and local civic governance and conservation organizations as well as local print, radio, television and electronic media to ensure that the public-at-large is aware of the potential solutions for advancing low-risk renewable energy siting. The two-decades long efforts to do so in the Flint Hills of Kansas offer an outstanding example of such efforts.

- At the state level, particular attention should be paid to executive branch (for example, Governors and their appointees), legislative and regulatory decisions regarding renewable energy markets, relevant state siting and permitting regulations, and renewable energy targets. For example, New York State has ambitious renewable energy targets; civic organizations such as Scenic Hudson have been working for years to make sure that those regulations are implemented in such a way that these targets are achieved with only modest impacts on open spaces that provide scenic, recreational and biodiversity habitat services. Similarly, TNC Chapters in Kansas, Oklahoma, and across the Site Wind Right states have work with state agencies and others to support renewable energy development that is low-risk to nature.

- At the local level, advocates for siting renewable energy facilities in low-risk areas have an opportunity to work with: town, municipal and county permitting and land use planning authorities to shape relevant siting regulations and their implementation; developers, utilities and transmission companies that are potential builders, buyers and carriers of renewable energy; and local civic governance and conservation organizations; as well as local print, radio, television and electronic media to ensure that the public-at-large is aware of the potential impact of energy siting decisions. The two-decades-long efforts to do so in the Flint Hills of Kansas offer an outstanding example of such efforts.

- At the state level, particular attention should be paid to executive branch (for example, governors and their appointees), legislative and regulatory decisions regarding renewable energy markets, relevant state siting and permitting regulations, and renewable energy targets. For example, New York State has ambitious renewable energy targets; civic organizations such as Scenic Hudson have been working for years to make sure that those regulations are implemented in such a way that these targets are achieved with only modest impacts on open spaces that provide scenic, recreational and biodiversity habitat services. Similarly, TNC Chapters in Kansas and Oklahoma have worked with regulators as well as media outlets in their respective services areas to provide necessary perspective at a statewide level.

- At the national level, particular attention should be paid to developments such as wind farms and large solar installation on federal lands. Well-designed initiatives can accelerate appropriate development and conserve important habitat zones. For example, during the Obama Administration, the Bureau of Land Management developed a Western Solar Plan that identified some 1,500 square kilometers of solar energy zones and excludes about 320,000 square kilometers from solar energy development. This was done through a Programmatic Environmental Impact Study (PEIS). McKenney and Wilkinson report that "the approach sought to advance solar development by 'pre-approving' zones that are appropriate for both solar potential and environmental values rather than requiring project-by-project impact analyses… Since approval of the PEIS, several large-scale solar projects have been approved in the zones and the project approval time for these projects was cut by more than half—approval of these three projects took 10 months instead of the typical 18 to 24 months. As a result, not only were the developers' costs and risks reduced, but the projects were developed on lands deemed of low conservation value."[82]

  In addition, federal procurement practices, federal financing of renewable energy projects (such as loan guarantees) and permits (such as those for transmission network siting) can strongly impact renewable energy facility siting. In 2021, with the advent of a new federal administration, there is a new opportunity to advance policies and practices that help drive renewable energy project siting to low-risk areas.

- At the level of Multilateral Financial Institutions such as the World Bank and the InterAmerican Development Bank, there are similar opportunities to advocate for the establishment of lending guidelines that encourage governments, developers, utilities and bulk electricity buyers to give preference to renewable energy power sources that can certify that their electric facilities are sited in low-risk areas.

- At the level of International and Global Institutions, NGOs and networks such as the International Union for the Conservation of Nature, the United Nations Environment Programme, WWF, BirdLife International, Conservation International, The International Land Conservation Network, The Rainforest Trust and a great many other organizations doing outstanding work in the fields of sustainability and conservation, there are a number of important forums at which the ideas embedded in Site Wind Right can usefully be discussed, and emerging knowledge and know-how regarding renewable energy facility siting should be shared. For example, in meetings focused on the goal of protection of 30 percent of the globe's land and water surfaces by the year 2030, such as the upcoming Fifteenth Conference of the Parties to the Convention on Biodiversity Conservation (COP 15 of the CBD), the subject of how to site renewables appropriately to address the climate crisis *and, at the same time* protect vast areas of land to address the massive loss of global biodiversity, is of great relevance and significance, and could be a productive topic of focus.

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Appendix 1: Study Group Questions

One of the several uses of this case profile is in an academic setting. Following are several questions that an instructor can pose to their study group to engage participants in the details of the narrative.

1. Is this a novel initiative? How have the protagonists creatively addressed the potential conflicts between renewable energy development and biodiversity conservation at the local level? At the statewide levels for Kansas and Oklahoma. At continental and global scales?

2. Is the solution which is emerging from this case measurably effective and strategically significant for the practice of land and biodiversity conservation? Why and why not?

3. Is the solution emerging from this case transferable to other jurisdictions and will it endure?

4. Is this a large landscape solution that crosses sectors and political jurisdictions? Who are the key players from various sectors essential to the success of this initiative? What are the key technologies and organizational methodologies?

5. If you were manager of the Site Wind Right project, what would be your priorities for action in the next year? Over the next ten years?

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