Chapter 12

100 Miles of Wild: North Dakota Badlands Transect

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The North Dakota badlands are little visited not just because of their distance from large populations, but also because they are physically challenging. What look like rugged but traversable hills from a roadside overlook quickly become a maze of endless ups and downs that twist upon themselves, exposed to the sun, without shade or water. Little infrastructure has been put in place to support travelers by foot. Thus the areas between the roads remain almost unvisited. This project has its origins in the half-formed plans of Richard Rothaus and Andrew Reinhard for a "simple" backpacking trek in the badlands just for fun, to try to capture some of the inspiration felt by the young Theodore Roosevelt when he visited the badlands.

In their planning, as Rothaus described the impact of the Bakken oil boom to Reinhard, the duo came up with a vision for something greater than a trip: a transect, cutting cross-terrain, to see how many inspiring areas of wild were still out there in the middle of a boom. While not particularly hazardous, the badlands are difficult, and the transect envisioned called for individuals at the peak of physical conditions, and this is where the juncture with Adventure Science was formed. Adventure Science is a collective focused on citizen-scientist explorations of rugged and remote places to answer questions out of the reach of the casual traveler. Rothaus had previously participated in Adventure Science expeditions, and he and Reinhard worked with Adventure Science founder Simon Donato to create 100 Miles of Wild: North Dakota Badlands Transect

The 100 Miles of Wild project had a simple aim: go to a little visited area of North Dakota and discover firsthand the condition of the wild that inspired Roosevelt's effort to preserve wilderness for all Americans and the world. But to do that, the team devised a series of difficult transects, across rather than with the rugged terrain, matched with a systematic collection of quantifiable and impressionistic data, photos and video. The

Figure 1. North Dakota Badlands, Courtesy of EcoFlight.

Adventure Science project was self-funded and self-organized, to ensure that we could remain an unbiased voice as we discuss these sensitive areas. As teams hiked a collective 270 miles of transects it became apparent that the difficult geography of the badlands have shielded the landscape from large-scale development. The transects ran primarily through the federally managed Little Missouri National Grasslands. The Grasslands are not a designated wilderness area, and the mandate of the U.S. Department of Agriculture is to use the lands for the public good, a use that currently includes grazing and oil development. The rugged nature of the Grasslands has, however, led to an area largely undisturbed except by ranching until the current oil boom.

Team members were Jane Davis (Community Health Educator), Dr. Simon Donato (Geologist), Jessica Kuepfer (Writer), Tyler LeBlanc (Paramedic), Dr. Tim Puetz (Biomedical Researcher), Andrew Reinhard (Archaeologist), Dr. Richard Rothaus (Archaeologist and Historian), Keith Slater (Search and Rescue), and Melissa Rae Stewart (Public Relations). North Dakotan Aaron Barth (Historian) provided assistance at a critical juncture when one team member (Rothaus) became ill.

The terms "wild" and "wilderness" are, of course, somewhat subjective. In a strict definition as an area untouched by human hands, true wilderness areas in the continental United States are uncommon and highly fragmented. The word "wilderness" itself is loaded with cultural connotations and conventions; the sublime religious experience, rugged frontier individualism, an area untouched by human hands (Cronon 1996). In this document we have tended to use the word "wild" to avoid these issues. The parlance among the team members, who were not, after all, scholars debating such issues, included both "wild" and "wilderness." But for a group of pragmatic individuals with extensive experience in the "wild," we used the a definition of "wild" or "wilderness" not as a place untouched, but rather a place where the touch is not a dominant feature of the landscape. This type of wild varies based on the perception of individuals, and the team was carefully chosen to include only participants who had worldwide travel experience in exceptional wild areas. Thus when the team notes say something "felt like wilderness," their point of reference is more likely to a place such as Borneo rather than a local park.

Introduction and Rational for Project

North Dakota's historic legacy is rooted in its character as "wilderness," and recent tourist campaigns tout the openness of the western half of the state, usually with golden sunlight and the tagline "Legendary." North Dakota is indeed a vast state with scattered outposts of small towns, but

Figure 2. Adventure Science Team (left to right, Tyler LeBlanc, Andrew Reimhard. Tim Puetz, Jessica Kuepfer, Jane Davis, Keith Slater, Richard Rothaus, Simon Donato). Photo courtesy of the Adventure Science Team.

it is also a state that is currently facing a significant land use challenges. Now a star of oil boom stories, until recently, the State was best known for its wide open spaces, ranching and agriculture. The wilds of the internationally famous badlands of North Dakota offered inspiration and consolation to a young Theodore Roosevelt, reeling from the deaths of his mother and wife in the early 1880s. As President, Roosevelt, remembering his life-changing experiences as a temporary cowboy and ranch owner, vigorous established his legacy of conservation by establishing five national parks, creating the U.S. Forest Service, and signing into law the Antiquities Act (Brinkley 2010, Morris 1979, Morris 2010). North Dakota today still shares much with the Dakotas of the early nineteenth century. The state has the fourth lowest population density in the U.S., with less than 10 people per square mile. North Dakota has a long history of progressive, independent, self-sufficiency, and is the homeland of several Native American Tribes that still thrive there today (Robinson et al. 1995).

North Dakota is also in the midst of a shale oil boom. This is not North Dakota's first oil boom, but it is by far its largest. The boom has brought with it road construction, drilling, pipelines, and infrastructure throughout the oil rich Bakken Formation, which underlies northwestern North Dakota, North Eastern Montana, and a large swatch of southern Saskatchewan. This boom is driven by new technologies, with oil extraction accomplished by drilling lengthy horizontal wells, and then fracturing the shale formation (fracking) to release trapped oil.

The rapid pace of the massive industry behind the oil boom has caused a breathtaking expansion of drilling pads and roads into the previously "empty" interior of North Dakota. Questions about the environmental impact abound. While the oil companies adhere to the state and federal regulations on development, the growth and rapid advance of the drilling front is at a scale that is difficult for anyone to perceive and understand. This has created significant polarity among North Dakota residents—some opposed to the rapid growth, others in support of it, all deeply affected by it. Our project sought to understand that impact through experiences that paralleled the way Roosevelt immersed himself in the land, to see if we could or would have similar experiences and feelings.

The Transect Route and Methodology

From 22 April to 2 May 2013, Adventure Science undertook the 100 Miles of Wild: North Dakota Badlands Transect, the only project of its kind across the rugged badlands. Rather than take the established Maah-Daah-Hey Trail, the team navigated primarily off-trail through areas of

Figure 3. Badlands Oil Pad Photo courtesy of the Adventure Science Team.

interest. To tie itself to the history of the region, the trek started at the North Unit of Theodore Roosevelt National Park (TRNP), headed to Theodore Roosevelt's Elkhorn Ranch, and concluded at the South Unit of TRNP near Medora (Kaye et al. 1993; Rogers 2006). The teams traveled on foot to seldom visited, isolated places within the badlands, typically staying within the boundaries of the federally administered Little Missouri National Grassland. Three two-person teams were deployed daily and tasked with covering distances between 10–25 miles each day. These teams, Team Tortoise, Speed Deer, and Mountain Kitty, were assigned routes designed to cross varied and difficult landforms, with an emphasis on traveling to places no one goes to on foot. For this project, the journey, not the destination, was important.

While deployed, the teams were charged with observing and recording their impressions of the native flora and fauna, as well as any manmade features. Documentation was done with the goal of establishing a description and personal sense of this landscape. The data also was collected so that it can be used to create a "baseline" impression of the land. While certainly not the equivalent of an environmental or archaeological inventory, the record is sufficient to capture a snapshot view of current conditions in the badlands. This can be used, for example, as a point of comparison to the state of the badlands when Roosevelt visited in the nineteenth century. More deliberately, we have consciously sought to collect a record that can be used in the future to gauge the impact of the Bakken Oil Boom. A redocumentation of the transect in the future, for example, would reveal much about the impact of the oil boom.

Team routes and recordation locations were carefully tracked with GPS units. While making their transects, teams were required to stop every few hours to record their experiences and observations. Each of these locations was designated as a log point, and at each of these team members recorded a photo and video panorama, and took notes on what they observed and felt. Team notes included an assessment of their location and signs of "civilization" they could see, the sounds and smells of the location, and perhaps most importantly the feeling of their location. Teams also recorded natural and anthropogenic features, and included a narrative of their travels between log points. This method of recordation was designed in part to overcome the inability to collect quantifiable data from a quick pedestrian transect, and in part out of recognition that the project aim was to collect the feeling of the landscape, which is inherently personal and non-quantifiable. Additionally, this data was appropriate for collection by individuals with extensive wilderness experience but lacking discrete scientific skills applicable to this landscape. At the end of each

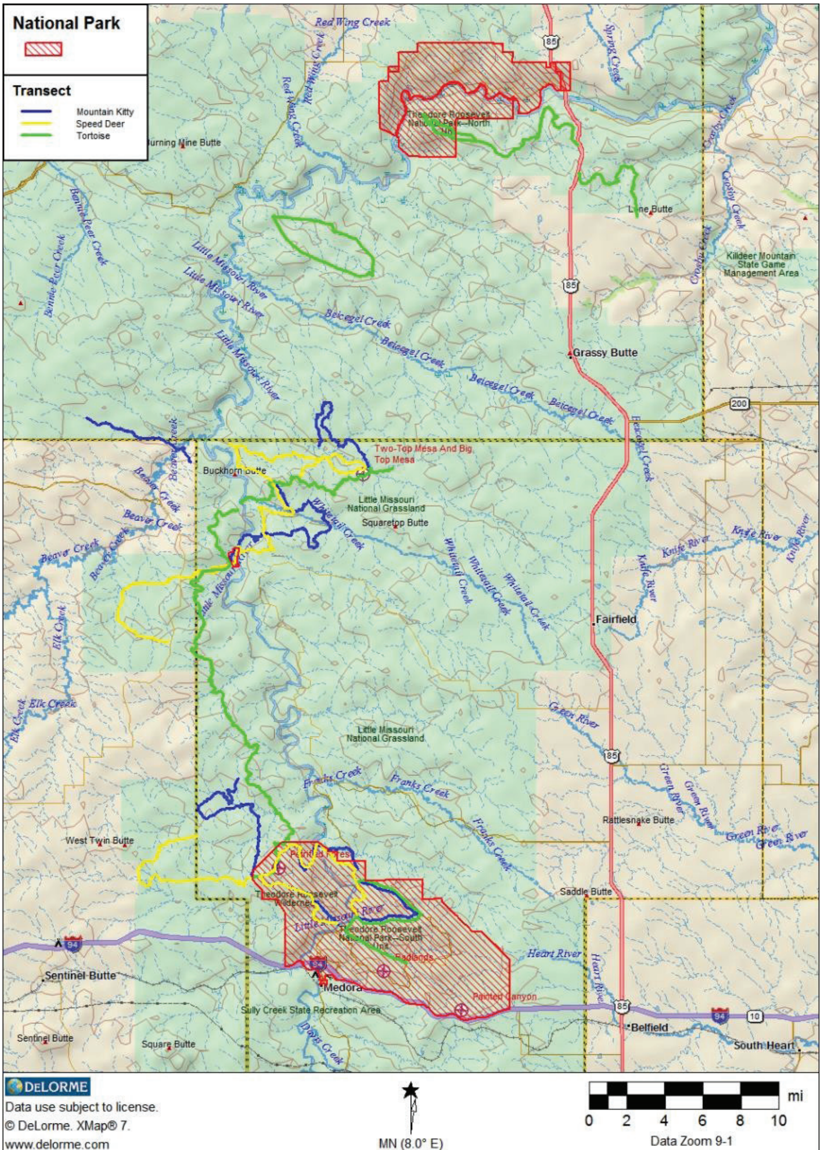


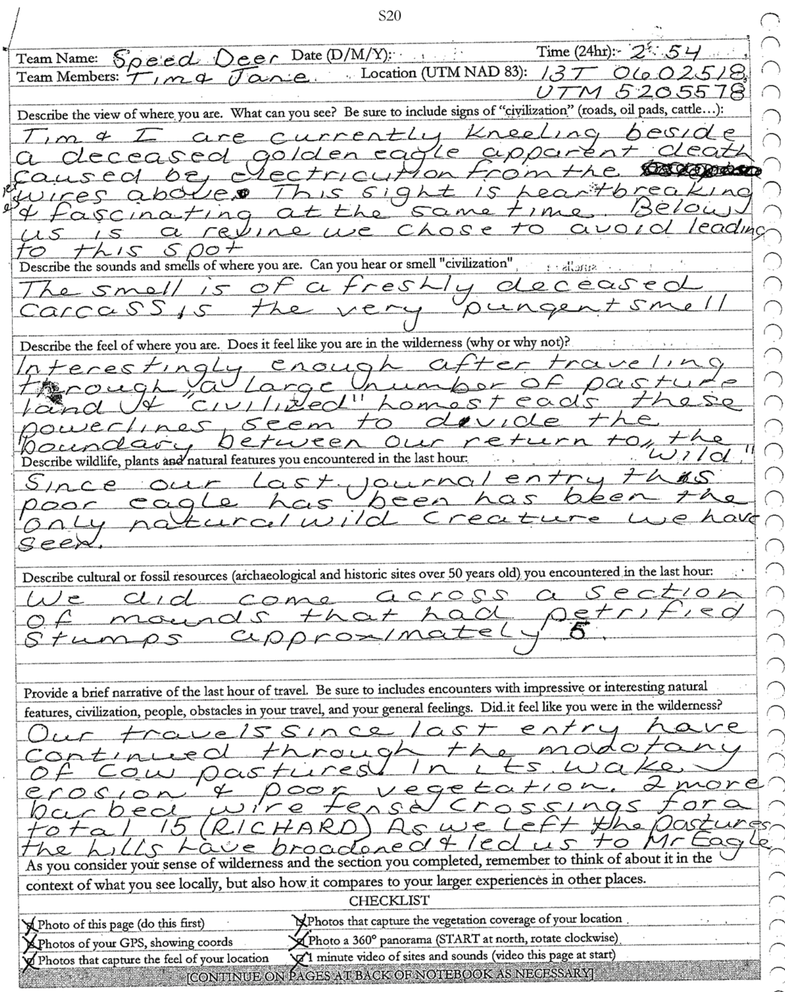
Figure 4. Transect Routes.
Map courtesy of the Adventure Science Team.

day, a debriefing was held, and each team shared what they learned about the state of they found to be an inspiring wild place.

Team Tortoise, led by Andrew Reinhard, who personally walked over 200 miles, spent the most time in the badlands, traveling 185 miles from Lone Butte east of the North Unit of TRNP to the TNRP South Unit. Team Tortoise was charged with traveling slowly and recording their impressions with more detail than the other teams. The transect for Team Tortoise began in one of the most remote locations and slowly transitioned into a route paralleling the Mah-Daah-Hey Trail. This team began during a heavy snow melt, and the route was modified and truncated in part by areas made impassable. In the spring, when the slick clays of the badlands are saturated, it becomes impossible to climb many slopes that would be only moderately challenging in dry conditions. Team Tortoise gained a total of 16,415 feet of elevation over the course of the transect, an indicator of the extreme ruggedness of the territory. While no single climb or peak is particularly notable, the repeated ups and downs equated to climbing more than three-fourths of the elevation of Mt. McKinley.

Team Tortoise spent the first two days traveling from log points T1 to T10 through difficult terrain that was farthest removed from oil development and ranching. Usually the only sign of human impact was very faint highway noise. Days three and four saw a marked increase in the evidence of historic and active ranching, which, despite the absence of oil development, made those areas feel less wild. As the team made its way south from the fifth day onwards, evidence of man became more frequent, with generally ubiquitous evidence of ranching, and more frequent observance of oil development and infrastructure. Finding areas with a truly wild feel became far less common due greater fragmentation. The area where the transect began (T1 to T4), Lone Butte, which has been proposed for designation as a roadless area, was perhaps the most "wild" of all the areas encountered by the teams. Team Tortoise recorded thirty-three log points (T1–T33) (North Dakota Wilderness Coalition 2008).

Team Speed Deer, led by Dr. Timothy Puetz, was a fast moving team and covered a total of eighty-six miles from Magpie Creek Camp to TRNP South Unit, with 14,530 feet of elevation gain. Using the same parameters for determining "wilderness" as Team Tortoise, the team found "wilderness" in a very fragmentary state from log points S1 to S18. Team Speed Deer found signs of the oil development common, as well as variable levels of disturbance of the ecosystem through ranching. As the team neared the TRNP South Unit, the landscape did become wilder, and far less developed (log points S19–S22). Team Speed Deer recorded twenty-two log points (S1–S22).



S20

Team Name: Speed Deer Date (D/M/Y): Time (24hr): 2:54
Team Members: Tim & Jane. Location (UTM NAD 83): 13T 0602518
UTM 5205578

Describe the view of where you are. What can you see? Be sure to include signs of "civilization" (roads, oil pads, cattle…):

Tim & I are currently kneeling beside a deceased golden eagle apparent death caused by electricution from the wires above. This sight is heartbreaking & fascinating at the same time. Below us is a revine we chose to avoid leading to this spot

Describe the sounds and smells of where you are. Can you hear or smell "civilization"

The smell is of a freshly deceased carcass is the very pungent smell

Describe the feel of where you are. Does it feel like you are in the wilderness (why or why not)?

Interestingly enough after traveling through "a large number of pasture land & "civilized" homesteads these powerlines seem to divide the boundary between our return to "the "wild"

Describe wildlife, plants and natural features you encountered in the last hour:

Since our last journal entry this poor eagle has been has been the only natural wild creature we have seen.

Describe cultural or fossil resources (archaeological and historic sites over 50 years old) you encountered in the last hour:

We did come across a section of mounds that had petrified stumps approximately 5.

Provide a brief narrative of the last hour of travel. Be sure to includes encounters with impressive or interesting natural features, civilization, people, obstacles in your travel, and your general feelings. Did it feel like you were in the wilderness?

Our travels since last entry have continued through the modotany of cow pastures. In its wake erosion & poor vegetation. 2 more barbed wire fense crossings for a total 15 (RICHARD) As we left the pastures the hills have broadened & led us to Mr Eagle.

As you consider your sense of wilderness and the section you completed, remember to think of about it in the context of what you see locally, but also how it compares to your larger experiences in other places.

CHECKLIST

- ☒ Photo of this page (do this first)
- ☒ Photos of your GPS, showing coords
- ☒ Photos that capture the feel of your location
- ☒ Photos that capture the vegetation coverage of your location
- ☒ Photo a 360° panorama (START at north, rotate clockwise)
- ☒ 1 minute video of sites and sounds (video this page at start)

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Figure 5. Sample Log Entry.
Image courtesy of the Adventure Science Team.

Mountain Kitty was led by Dr. Simon Donato, and covered seventy-nine miles with 16,474 feet of elevation gain from April 28 to May 2, 2013. Their data corroborates the Team Tortoise and Speed Deer findings, in that between log point M1 to M10, areas of true wilderness were highly fragmented, discontinuous, and not geographically extensive. From log point M11 to M17 the landscape showed less signs of impact from ranching, oil development significantly declined, and the sense of wild grew. Mountain Kitty recorded 17 log points (M1–M17).

The consistent thread amongst all three teams was that wild areas are still present albeit variable. These areas however, are severely fragmented and discontinuous. Teams traveled into and out of areas of wild, with the transition sometimes being quite abrupt as canyons would lead to new, scoria topped roads, and active well pads. All the transects experienced a situation where the wild could still be encountered, but immersion was short-lived.

Overview of Findings

The challenge of blending the semi-impressionistic records of a large team is significant, so here we have tried to present a mix of informed interpretations and data summaries. Using the log point data, we have been able to describe how frequently the teams encountered oil development, roads, ranching, paleontological and archaeological sites, wildlife, manmade noise and other people. Not only does this information provide a context that allows readers to determine if our overall impressions are reasonable, it also provides a base data set that can be checked in future years, by different people. One unique aspect of this dataset is that it is tied to experience on the ground. While similar information can be gathered remotely, from satellite images for example, the translation of those datasets to what a human might experience, much less their emotional reaction, is difficult.

Oil Development

The most direct and obvious measure of the impact of the current boom in remote areas is well pads and roads. While the team was on the lookout for obvious major unregulated impacts (e.g., illegal dumping, oil spills), we knew that a handful of people were unlikely to stumble across such on Federal lands, and indeed we found none. Through the transect data, however, the team gained a good overview of the impact of the most critical above ground infrastructure of access roads and well pads.

Figure 6. Andrew Reinhard. Photo courtesy of the Adventure Science Team.

The transect was conducted in the earliest days of spring when minimal drilling activity occurs. Thus our impression of wild via the transect lacks the impact of active drilling and fracking, and the associated very heavy truck traffic. As those who live or work near a well being actively drilled or fracked have reported, the noise and traffic are significant. That said, our data reflects the more permanent infrastructure that will be left behind when active drilling is reduced or over.

The teams did not record every pad that they passed by on their respective transects, but only those that they were able to see during their observational stops. Stops were determined at team discretion, as determined by time (about every 60 to 120 minutes), changing terrain, and the instructions that, for an impressionistic study, stopping at interesting landforms was more important than regular spacing. Well pads and derricks that were visible in the far distance (typically more than one or two miles) were not recorded as present at the observation point.

Pad construction was generally basic, with holding tanks, derrick, several small out buildings, and a containment berms of varying heights. Litter was rare at most sites visited, and most pads were free of spills, odor, and noise. No unconfined liquids were encountered. In addition, Federal Grasslands regulations require derricks to be painted a matte taupe, which works well to minimize the visual impacts. Not all impacts are visible, of course, and teams carried Hydrogen Sulfide (H2S) monitors to detect this deadly colorless gas sometimes emited by wells. No H2S sources were recorded during the expedition. Members of the team who had experience in other oil fields noted that the well pads we encountered were among the neatest and cleanest they had seen, presumably a result of regulations and oversight by the USFS. Team member without oilfield experience reported that the paths were much cleaner and trash-free than they anticipated. There was some thought, however, that containment berms were rather uncommon compared to other areas.

Oil pads were typically clustered in valley bottoms, which is normal when producing an oil field, and when a team would encounter one pad, they would encounter several. Overall, the transect taken by team Mountain Kitty resulted in the lowest percentage of wells viewed at their observation stops (24 percent), while Speed Deer encountered the most (41 percent), and Tortoise was at the low end of the spectrum (27 percent). The results indicate that the presence of well pads is a significant and now permanent part of the experience for any recreational user of the badlands. As Tim Puetz expressed it, the omnipresence of the well pads is significant: “We knew [oil] was always with us, like we were walking hand-in-hand.”

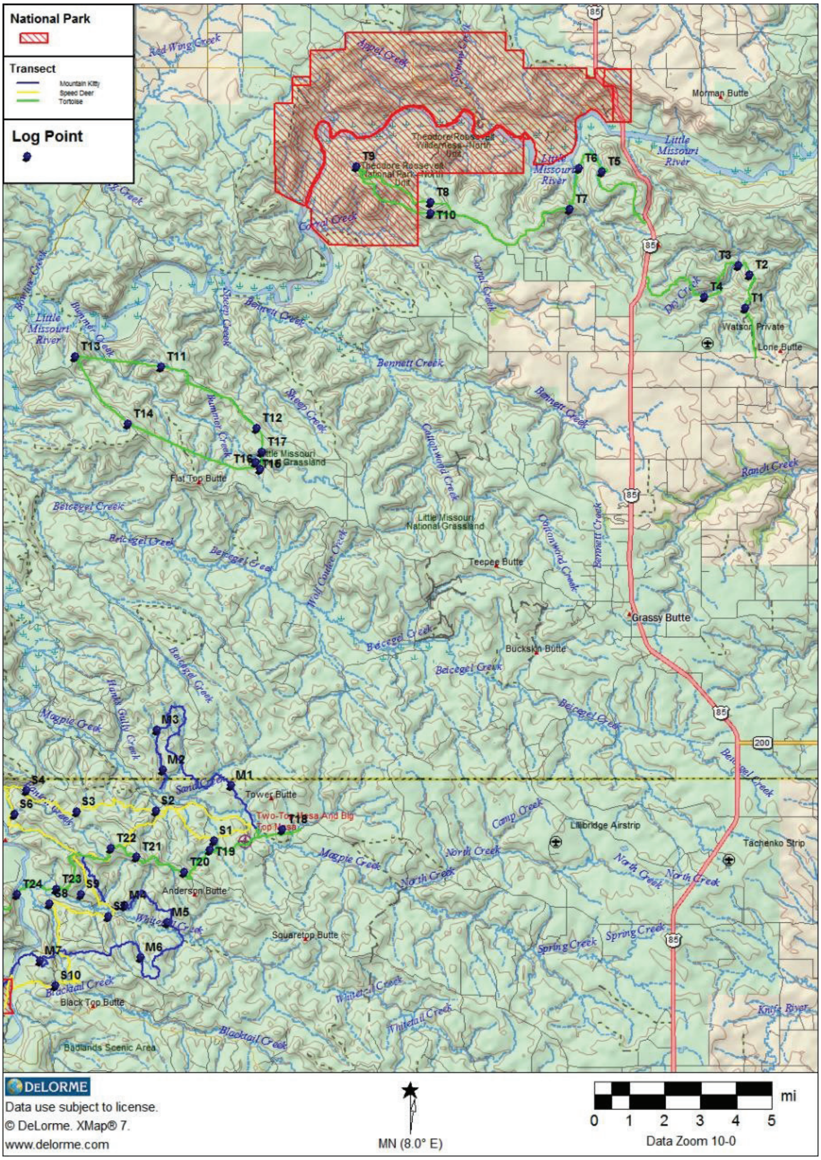

Figure 7. Log Points, North
Map courtesy of the Adventure Science Team.

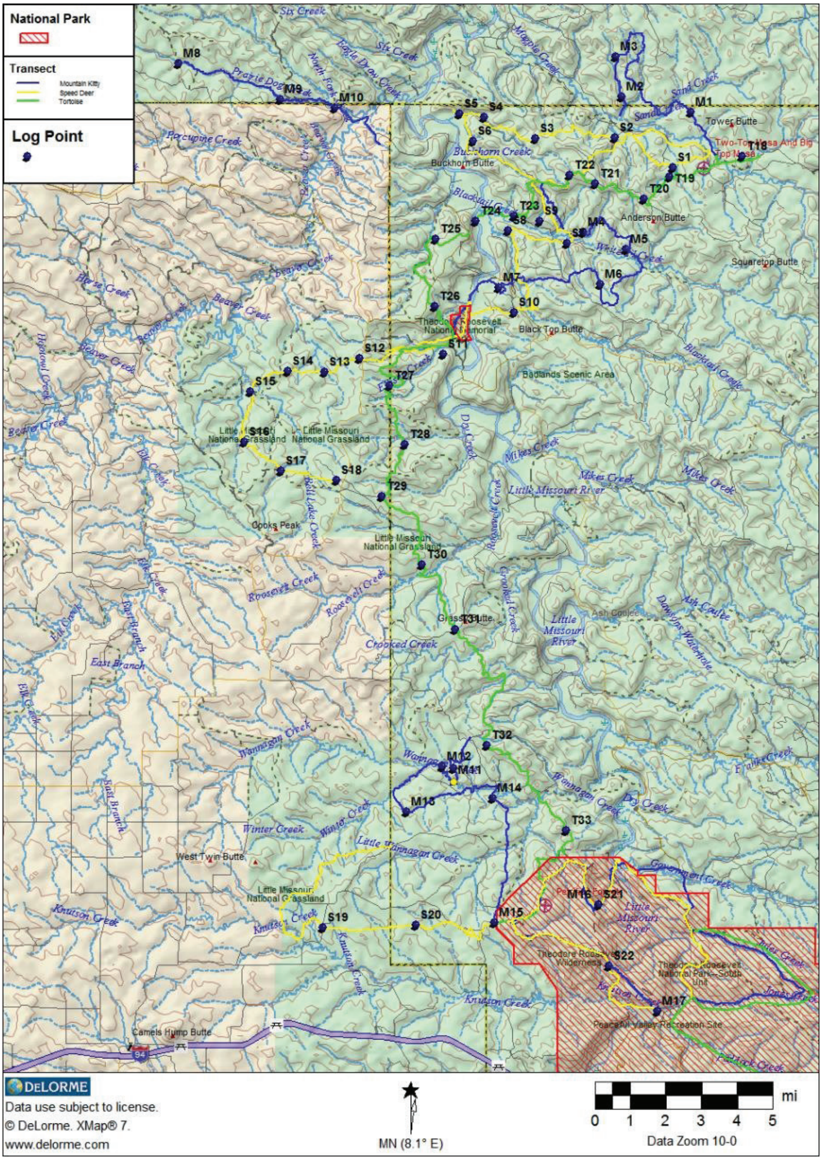

Figure 8. Log Points, South.
Map courtesy of the Adventure Science Team.

Figure 9. Kuepfer Navigates a Ridgeline. Photo courtesy of the Adventure Science Team.

By far, the most vivid evidence of the oil industry along the transect routes were the scoria topped roads. Scoria, or clinker, is a locally available sedimentary rock that is baked in the ground following natural fires in adjacent coal seam. Lightning strikes are the most common cause of such fires. The fragmented scoria is a striking red color, and natural beds of it bisects numerous badland valleys. With local gravel sources few and far between, clinker is the default road construction material, as it is hard and relatively durable. Those who drive on it will tell you that it is sharper than gravel, wreaks havoc on tires, and wears out quickly. But it works well enough to stabilize the bentonite clay soils, which otherwise becomes impassable during wet periods.

The bright red clinker topped roads snaking through isolated valleys boldly announce the presence of pads, and on their own have created a major visual impact on the badlands. As with well pads, roads that were visible in the far distance (typically more than one or two miles) were not recorded as present at the observation point. Speed Deer observed roads at 68 percent of their observational stops, while Mountain Kitty and Tortoise saw roads at less than half of their stops (41 percent and 36 percent respectively). These numbers indicate that for the badland traveler trying to avoid civilization, a road will be visible more than a third of the time. Moreover, these roads are predominately made of the red scoria, which marks a strong contrast with the surrounding landscape, as the long roads reach to the horizon. Consensus among the team members was that the roads were by far the more visible indicator of oil development, and also had the larger impact on their sense of wild. The bright red color of the network of roads led the team to refer to them as "scars."

Ranching

Ranching is synonymous with North Dakota. With a history stretching back into the 1800s, even Theodore Roosevelt was drawn to North Dakota as much for its ranching as for its wild. His Elkhorn home was, during its time, his attempt at a cattle ranch. Ranching is still alive and well in the badlands, and all teams consistently encountered evidence of this. Fences, watering and feed stations, cattle tracks, and the ubiquitous cow pats were the obvious signs, and they appeared in such quantities that only their absence was notable. Most ranching areas were simply grazing lands, and few structures, aside from watering stations, were observed in these areas. While there was some historic farming in the area, such land usage is increasingly uncommon.

Even though there still was snow on the ground in places, grazing was evident nearly everywhere. The difference between ungrazed and

Figure 10. Workover Rig.
Photo courtesy of the Adventure Science Team.

moderately to heavily grazed areas was obvious by the flora present. Ungrazed or lightly grazed areas were strongly dominated by grasses—the native flora of the non-wooded regions in the badlands. Areas where grazing pressure was high displayed a mixed flora, with thistle and other inedible plants common or even dominant. Since it was calving season during our expedition, the cattle had withdrawn to sheltered locations, and were not often observed in pasture.

All teams recorded a strong presence of ranching, with evidence in nearly all badland environs and landscapes. Mountain Kitty identified ranching evidence in 82 percent of their observation stops, while Tortoise observed it in 61 percent, and Speed Deer in only 46 percent. The patterning reflects, presumably, grazing leases on the Federal lands, which are likewise determined in part by proximity to roads and private lands. Participants found that ranching had a major impact on their experience in traversing and camping in the badlands. A daily and continual nuisance was the ubiquitous cow manure. In areas where grazing was ongoing, there was nary a place to stand, sit, or pitch a tent that was not covered in manure. All areas with standing water were trampled and contaminated. One participant explained the situation in comparison with oil development: "we can turn our backs back on oil pads and forget about them for a while, but the never-ending slipping and dodging manure made some areas more akin to feedlots than wilderness."

Geology, Paleontology, and Archaeology

The geology of this region is generally well understood, and the North Dakota Geologic Survey (www.dmr.nd.gov/ndgs/) has published a significant amount of detailed information online. Briefly, the stratigraphy that outcropped in the badlands, forming the buttes and ridges observed during the expedition is predominantly composed of Paleocene (66 to 56 million years ago) sandstones, silts, clays, coal, and clinker. In the valleys and ranch lands, especially near the Little Missouri River, Pleistocene (3 million to 12,000 years ago) to modern aged alluvial sediments dominated. Paleocene and Pleistocene fossils are numerous throughout the area covered by the transect. Prehistoric archaeological sites in the badlands (which are not overly abundant) can be difficult for the non-expert to identify, as they usually are expressed by small lithic scatters. A number of 30–50-year-old farming, ranching, and mining implements were noted during the survey, but these were not recorded individually. Fences were ubiquitous.

Subject matter experts instructed teams on how to recognize common fossils, stone artifacts or tools, historical implements, landform

Figure 11. Fence Line.
Photo courtesy of the Adventure Science Team.

modifications, and similar features to identify paleontological, archaeological, or cultural or historic sites of potential significance. Despite this, it is a challenge to recognize many of these in the field, even for the experts, and especially during a rapid survey. Team members were instructed in the legal and ethical necessities of non-disturbance. In hindsight, we wished we had trained all team members to identify erosional bone beds. These are one of the more easily identifiable sites, and we learned *en route* that while our team members were not at first noticing these, a brief onsite training brought them up to speed quickly.

Most of the exposed rock, clay, and bentonite explored during the transect were devoid of vertebrate or invertebrate fossils. No vertebrate fossils of Mesozoic age (252 to 66 million years ago) were identified, but invertebrates (marine bivalves, presumably Paleocene) were regularly observed during the trek. By far, the most abundant large fossils in this area are fossilized tree trunks, which are very common and in some areas litter the surface for several hundred square meters. Fossil trees were so numerous they were not individually documented, and only large fossils or clusters tended to be recorded in the notes.

Stratified Pleistocene and Holocene (12,000 years ago to the present) alluvial deposits were common as fill in the valleys. These deposits record fluvial activity and tend to be highly fossiliferous, with well preserved bison material weathering out of creek banks in numerous locations visited. Exploring creeks proved worthwhile, as their eroded banks yielded some excellent bison dominated bone clusters. The oldest bone fragments were found at the boundary of the conglomerate-sandstone interface. Above this, bones were more common, often with clusters of several bones weathering out from a certain interval. Bison bones dominated the assemblage, and lower limb bones were most prevalent. Several locations yielded intact bison skulls. These bone bed sites were recorded with GPS, photos, and brief descriptions. No collection of artifacts or materials occurred.

No definitive prehistoric archaeological sites were identified. Abundant skeletal remains of bison, horse, and other plains mammals were observed and recorded during the expedition. A possible chert scraper found in association with a bison bone bed (log point M12), suggests that this may be an archaeological site. At this location, bone density increased upwards in the column, before vanishing abruptly in the upper meter of sediment. This abrupt disappearance may coincide with the extermination of bison by hunters in the late 1800s (Hornaday 1889; Lueck 2002).

The observance of fossil or cultural material suffered an educational training bias, as only one team leader is a paleontologist, and only two team members were archaeologists. This aside, Team Mountain Kitty

Figure 12. Cattle.
Photo courtesy of the Adventure Science Team.

Figure 13. Bison Bone in Bone Bed.
Photo courtesy of the Adventure Science Team.

(which had a paleontologist as a leader) saw fossil or cultural material at 53 percent of their stops, while Tortoise saw it at 24 percent, and Speed Deer 23 percent. These relatively high numbers as tallied by nonspecialists only hint at the abundance of the fossil an archaeological resources in the area of the transects.

Wildlife and Environment

A late spring limited the wildlife visible, as birds were just returning to the landscape, and many mammals were still in secluded areas. Evidence for wildlife included animal and bird sightings, tracks, and the discovery of skeletal remains and antlers. A number of species were directly observed including big horn sheep, mule deer, eagles, coyote, rabbits, beaver and pronghorn. Bison, wild horses, and elk were observed only in the TRNP. Mountain Lion tracks were ubiquitous in any area near streams or springs, and wolf or coyote tracks were not uncommon. Possible bear scat was noted near the North Unit of the park. A number of bird species were observed, although not identified.

Due to the time of year and cold temperatures, insects, amphibians, and reptiles were not very active, although frogs were heard. Two Golden Eagles were observed during the survey—one alive, the other recently deceased, apparently by electrocution as it was found directly under live power lines connected to an active oil well.

Teams recorded evidence of wildlife presence at most of their stops (Mountain Kitty 94 percent, Tortoise 84 percent, and Speed Deer 68 percent). Wildlife was present in areas with well pad activity, although the only evidence observed of mountain lions and large wolf/coyote were made in more isolated, harder to reach areas.

The Human Presence

This landscape is generally unpopulated. Encounters with humans were rare, and they were restricted to service vehicles heading to well pads, or workers on pads. Outside of the TRNP South Unit, no other hikers or recreators were encountered. The North Dakota badlands can be a very windy landscape. The predominant sound for all the teams during this project was the wind. Occasionally, vehicular traffic from a nearby highway or a passing jet could be heard, but for the most part the auditory experience was thus one of moderate to near total isolation. The ubiquity of oil pads, roads, or ranching meant one never was far removed from a reminder of humans on this landscape, but the humans themselves

Figure 14. Kuepfer and Davis at Petrified Tree with Explorer's Club Flag. Photo courtesy of the Adventure Science Team.

Figure 15. Bison. Photo courtesy of the Adventure Science Team.

were rarely seen. There were also pockets where no human influence was readily detectable, especially in lowland areas. It should be remembered, however, that we did the transect during early spring, when roads were soft from meltwater and truck traffic was extremely limited.

Conclusions and Ideas

The badlands, referred to by General Alfred Sully as "Hell with the fires gone out," seem an unlikely place for a trip on foot, and that is precisely why the team undertook this project (Chaky 2012). While difficult, the terrain was not impossible. The main challenges, all anticipated, were navigating the confusing, rough terrain, temperature extremes, and the steep, unstable slopes. In the past, these challenges, combined with terrain unsuitable for horseback travel, and the sparse occupation of the area, generally kept people out. Off-road motorized vehicle travel is prohibited in much of the Federal land, and the inhospitable remoteness of the badlands has left the area largely undocumented and unexplored. Adventure Science's self-funded and self-organized transect has given us a unique window to view these badlands.

This expedition found that the wild that Theodore Roosevelt described so long ago does exist, but is highly fragmented. Ranching remains common, and the new change in the form of oil resource development is increasing. From the perspective of the Adventure Science team, the impact of ranching was far greater and more immediately visible than the impact of the boom. The most visually unappealing and perhaps major impact of oil development is the expansion of roads through these beautiful areas. Obviously the risk of oil spills, pipeline leaks, H2S release, and other accidents are real, but our expedition encountered none of these. The reader should note, however, that if oil development in this area continues, this situation could and will change significantly. This transect provides an excellent baseline for a followup expedition that will be able to analyze and document change at a level of detail previously not possible.

Adventure Science is not an activist group, and our goal was documentation, not recommendations. All participants were struck, however, by the rather shocking recent fragmentation of the areas between the North and South Units of TRNP. While these Federal Grasslands were never intended to be wild, the level of fragmentation at a point when most oil exploration is still on private land is astonishing. The roads to oil pads and other areas have spread like a chaotic web. This fragmented state seems not only detrimental to the conservation and recreational mandates of the Grasslands, but unnecessarily damaging to the area. The

Figure 16. Mountain Lion Track
Photo courtesy of the Adventure Science Team.

myriad of roadways provide access for invasive species throughout the Grasslands, and during drilling season we are told they create a great deal of noise and dust. Just as the Adventure Science Team was never far from a road, it is increasingly difficult for wildlife to navigate this area without exposure to road disturbance and hazards. For the reticent and skittish key species of the area such as Bighorn Sheep and Golden Eagles, this is most problematic.

Given that the area remains quite wild, and this wildness could be preserved with some relatively small steps, it seems obvious to act on the part of preservation. This need is amplified by the relatively small sizes of the North and South Units of TRNP. Our work not only supports the already proposed idea for some roadless areas within the Grasslands, but suggests a most obvious need: centralized planning of access roads with an eye toward minimizing the spreading web, and maintaining open corridors for the natural inhabitants of the region (North Dakota Wilderness Coalition 2008). Equally obvious, albeit more difficult to achieve, would be the creation of a protected wild corridor linking the TRNP North and South units. While this idea probably is not politically feasible in an area with entrenched ranching interests in the midst of an oil boom, the reality remains that it could be achieved. Such a corridor could serve to allow the wild to expand, and return to its natural state, as well as give wildlife ways to move freely, unimpeded by fences, drilling activity, and busy roads. While we have doubts whether such a corridor will ever be created, we have little doubt that future residents will look back upon this period as a lost and last opportunity to have done so.

Afterword: The Badlands Transect Saved My Life

On the very first day of the transect I (Rothaus) started having trouble breathing and I assumed it was a flareup of asthma. I had suspected I would have trouble because training had gone hard. The first several days of the transect were just to be Reinhard and me, and we had asked Aaron Barth to come out and man a vehicle and to shuttle gear to increase my chances of success and be ready to get me just in case. With the help of inhalers and steroids, Reinhard and I struggled out of Lone Butte in freezing temperatures that first night, and we were pretty glad I was able to make it out before the cold really hit. I quit the ambitious transect plans and started consuming a maximum dose of steroids to keep going. Reinhard trekked alone until Tyler LeBlanc arrived and joined him, instead of being medical reserve as was the initial plan. I managed to walk about forty miles on boring, easy roads, each night moving my camp away

Figure 17. Scoria Roads and Well pads, Courtesy of EcoFlight.

Figure 18: Pipelines and Badlands.
Photo courtesy of the Adventure Science Team.

from the others so my coughing and inevitable retreat to a running truck for warm air would not disturb the others.

By the end of the transect I was a wreck. When my family arrived at the end for the victory celebration they were told "Wait till tonight; you'll see how bad he gets." I called ahead to my doctor at the University of Minnesota and told him, "I'm coming out of North Dakota. I can't breathe. I'm almost out of steroids. There is no way this will end well." Within a few days of return I was at the pulmonologist for treatment and testing. But this is not the interesting part. The pulmonologist tested away, and determined that I do not have asthma, which was quite the shock after a lifetime of trying to treat it. She found the pharmaceuticals that made my lungs work again, and we continued searching for a cause beyond some vague idiopathic inflammatory issue. We never have identified a discrete cause, but treatment is keeping me going. But this is not the part where the badlands saved my life.

While searching for a cause, my pulmonologist sent me to a gastroenterologist to get my throat scoped. Sometimes acid reflux can get into the lungs and cause breathing problems. I knew I had acid reflux, and I knew I was overdue for a checkup. I knew I had Barrett's esophagus, a condition where acid reflux causes the lining of the throat to convert into a lining more like that of the stomach. And I knew Barrett's esophagus was an indicator of cancer risk. The endoscopy found a small tumor, the biopsy found esophageal cancer, and I found that I am (so far) one of the lucky 5 percent who survive because we found it early, while looking for something else. The badlands transect broke me, sent me wheezing to the hospital, and saved my life. That is the interesting part.

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