

GREAT SAND HILLS REGIONAL ENVIRONMENTAL STUDY
– EXECUTIVE SUMMARY –

INTRODUCTION

The Great Sand Hills (GSH) of Saskatchewan are nationally and internationally significant as one of the largest remnants of native grassland in Canada—an island of mixed-grass prairie and shrubland in a sea of intensive agriculture. The GSH have remained essentially intact with high ecological integrity because their sandy soils and rugged terrain are not conducive to cultivation and because urban and industrial development in the region are minimal. The GSH are located within the physiographic region known as the third prairie level, Alberta High Plains or Alberta Plateau Region. The GSH are the largest of the sand dune complexes within the region, dominated by aeolian landforms where sand deposits were laid down by glacial meltwaters and subsequently modified and reworked by wind. The sand dunes include both stabilized and active dunes of varying shape and height, interspersed with areas of sand flats. The great expanse of native vegetation, combined with the rugged terrain, provides diverse habitats for many species.

The GSH Study Area (see below) is sparsely populated with 6,709 residents in 2001, of which approximately 60% resided within the jurisdiction of settlements. Ranching, gas development, and recreation are the major human activities in the area. The provincial Crown owns over 85% of the land within the heart of the GSH—the Review Area (see below)—of which most is under grazing lease and additionally protected under *The Wildlife Habitat Protection Act*. All of the Review Area is believed to have high potential for natural gas development, an important source of revenue for the province and the communities surrounding the GSH. In 2001 the labour force participation rates in the GSH area were higher than the Saskatchewan average with the majority of reporting settlements and Rural Municipalities (RMs) exceeding the Saskatchewan median family income. The majority of the labour force is engaged in occupations associated with the primary industry—agriculture, including farming and ranching—which accounts for 60-80% of all employment in the region and reflects some of the highest concentration of agricultural employment in Saskatchewan.

The only First Nation with a reserve near the GSH is the Nekaneet, located 121 km southwest of Swift Current and occupying 5,602 ha of land. At least part of the Great Sand Hills lies within the Qu'Appelle Treaty, signed in 1874, and the area itself is of considerable historic, cultural, spiritual, and economic significance to many First Nations, including the Saskatchewan Treaty

4 First Nations and the Blackfoot Confederacy of Alberta, as well as numerous other First Nations groups in Saskatchewan and North Dakota.

Concerns over impacts of economic development in the GSH, and conflicts among ranchers, the gas industry, and environmental conservation interests, have been of public concern for many years. In 2004 the Great Sand Hills Land Use Review Committee presented a report, subsequently accepted by the Government of Saskatchewan, calling for increased protection of environmental resources of the GSH and for a Regional Environmental Study (RES). The Great Sand Hills Representative Area Ecological Reserve (RAER) was designated in March of 2005, closely following a commitment by Government to undertake an RES. A Scientific Advisory Committee (SAC) was assembled by the Minister of Environment to conduct the RES, which was to involve a strategic assessment of human activities that affect the ecological integrity and sustainability of the area. Furthermore, the RES would serve as a comprehensive evaluation of natural, social, and economic capital of the GSH region under alternative future scenarios of conservation and development.

This report outlines the methodology and results of the RES and provides strategic recommendations to guide human activities in the GSH so that the long-term ecological integrity of the area is maintained while a corresponding level of environmental, socio-cultural, and economic benefits are realized. The basic research approach of the RES, following the general philosophy of Strategic Environmental Assessment, is scenario analysis. Rather than showing what will be, a scenario shows what could be if particular trends and rates of change (for example, in land use or development) take place over time. By comparing multiple, alternative future scenarios, decision-makers, scientists, and the general public are able to obtain a vivid picture of the consequences of different policies, management plans, or courses of action. Such comparisons allow decisions to be based not only on what has happened in the past, but on potential future trends.

The GSH RES focuses on two nested regions, a Study Area and a Review Area. The Study Area is delineated by 8 RMs (Piapot, Big Stick, Fox Valley, Happyland, Clinworth, Miry Creek, Pittville, Gull Lake) that surround the GSH and are the focus of the social and economic baseline studies. This area covers 10,016.47 km² or approximately 1.71% of Saskatchewan's total land-mass. The natural capital baseline studies focus largely on the Review Area, contained within the Study Area and delineated by the spatial extent of the dunes and

grasslands of the GSH. The Review Area is 2028.9 km² (783.4 mi²) of native prairie overlaying a more or less continuous surface deposit of unconsolidated sands. The area is sensitive to erosion if heavily disturbed. Currently the area is considered to have a high degree of ecological integrity, although invasive non-native plants are an increasing concern.

The GSH RES commenced with a baseline assessment (Part 2 of this report), which characterized the current and cumulative natural, social, and economic conditions of the GSH region that are consistent with its sustainability. This included an assessment of changes in selected baseline components over time. The baseline assessment was followed by an analysis of three alternative future scenarios. The scenario analysis phase examined the implications of alternative levels of human activity within the GSH, as indicated by deviation from current baseline conditions. The scenario projections focused on those human activities that have the greatest potential for surface disturbance and, therefore, for affecting the ecological integrity and sustainability of the GSH—namely those activities associated with gas development and ranching.

Recommendations associated with implementation of the preferred scenario included consideration of mitigation measures and monitoring requirements for maintaining the ecological integrity and sustainability of the GSH. The alternative scenarios considered in the RES, along with the assumptions and conditions of each, are detailed in Part 3. Recommendations consistent with the preferred scenario are discussed in Part 4. Each phase of the RES considered the input of affected stakeholders, interests, and First Nations.

BASELINE ASSESSMENT

Natural gas development has been ongoing in the GSH since the early 1950s, with the most intense development occurring since 1980. Current gas production from known reserves in production in the area is estimated at over 180 billion cubic feet (BCF), and proved, probable, and possible reserves are estimated at nearly 670 BCF. There are currently 132,370 ha of gas leases in the region and an additional 7,996 ha of leases for gas exploration, together representing approximately 70% of the GSH land base. On over 1,400 surface leases with single and multiple well heads per pad there are more than 1,500 gas wells. Most well pad surface leases are developed in the west and southwest portion of the Review Area. Vertically drilled wells, typically with one well head per pad on a surface lease, represent 84% of the total well

inventory. This development occurs in densities of up to 8 wells and 8 well pad surface leases per section in the Review Area. Lower-impact directional and slant drilling have occurred in some places, constrained, in part, by topography, reserve depth, cost, and the willingness of industry. In those areas where directional and slant drilling has occurred, there are cases where 8 wells per section have been sustained across only 1–4 well pads.

Activities associated with gas development have resulted in disturbance of native habitat at drilling sites, disturbance of habitat during pipeline construction, and an overall increase in human activity in the region. Although many of the individual disturbances associated with gas development are minimal in extent, and even positive for some disturbance-obligate species, gas development and maintenance activities cannot be considered independently of the impacts of roads and trails used for drilling and maintenance. In much of the gas-developed areas of the western GSH, for example, as well as in isolated patches on the eastern boundary, there are 2–3 km/km² of roads and trails, in many places exceeding 3 km/km². At the current scale of development, the cumulative impact of well pads and associated roads and trails for servicing infrastructure are overarching concerns in relation to sustaining the ecological integrity of the GSH, particularly in terms of the implications for biodiversity, habitat fragmentation, and the spread of non-native species.

Over 40% of participants in the RES baseline community social survey indicated some form of dependency on income from the gas industry, either in the form of wages from gas industry employment or from revenue generated from gas wells on their property. Approximately 85% welcomed gas development in the region and over two-thirds supported an increase in development of the gas industry, noting the positive impacts and benefits to regional communities and households. Indices of resource dependency and specialization in the GSH are higher than for many rural areas of the province, suggesting that the region is vulnerable to external market changes and government policies and initiatives both locally and beyond.

Livestock grazing has exerted a long-term and widespread influence on the landscape and integrity of the GSH. Ranching is considered by most respondents to be an ecologically acceptable activity in the GSH and acts as a cohesive influence for sustaining rural communities through support of local businesses and socially through helping retain population. The total current economic value of ranching in the GSH represents approximately

\$45 million annually in revenues, rents, income, and sales to the local and regional economy. Total potential economic contribution of ranching is projected to be over \$716 million in the next 15 years. However, many RES survey participants recognized the potential for environmental disturbance (e.g., dugouts and damaged pastures due to overgrazing) produced by ranching. Focal species habitat modeling suggested that although grazing is ubiquitous across the GSH, the most notable footprint is the over-concentration of animals around livestock watering holes. This concentration of animals has resulted in extensive vegetative trampling and soil erosion, poor range health, and an extensive network of permanent trails.

Baseline predictions of range health for the GSH suggest that 5% of the landscape is in an “unhealthy” condition, 42% in a “healthy, but with problems” condition, and 53% in a “healthy” condition. All three anthropogenic disturbances (gas well activity, roads and trails, and livestock watering holes) resulted in reductions of range health, but unhealthy conditions were most frequently associated with areas surrounding livestock watering holes. Reductions in range health around livestock watering holes were most pronounced within 250 m of the site. Reductions in range health due to gas well pads and roads and trails, while significant, are not as broad or as large in effect, with only slight decreases in range health within a 100-m buffer. Moderate reductions in range health in the vicinity of well pads appear to be partly due to aggregation of livestock. However, when considering the additive impacts of gas well pads and roads/trails and the sheer number of well pads and length of roads and trails, the cumulative reduction in range health from gas development is substantial.

In terms of focal species (i.e., the bird and plant species selected for detailed analysis in the RES), gas development itself does not appear to reduce occurrence; however, associated road and trail development does have negative impacts. Gas development activities at well pads produced no significant adverse impacts on the 8 rare and traditional-use plants considered in the baseline. However, most rare and traditional-use plants were not common in areas that coincide with current gas development, so it would be incorrect to conclude that expansion of gas activity would not result in significant impacts. Gas development is also associated with marginal increases in prevalence of crested wheatgrass, a non-native species that can lead to erosion of ecological integrity through reductions in native plant cover.

The presence of roads/trails has a significant, adverse impact on some rare plants, with the occurrence

of species affected up to 100–300 m from roadsides. The greatest threat to many species, however, may be from livestock trampling or competition from non-native plants. The non-native and invasive plants, crested wheatgrass and smooth brome, increase substantially along roads and trails. The impacts of roads and trails are also negative for a number of native grassland birds, although several species appeared to be positively associated with gas well pads, which may reflect selection for structure (e.g., perch sites) or enhanced habitat conditions for disturbance-evolved species. For livestock watering holes, all but one native focal species with significant responses decreased in occurrence near watering holes, while non-native plants increased in occurrence.

In addition to the overarching concern of surface disturbance, a number of direct and indirect interactions among Valued Ecosystem Components (VECs) and driving forces of change are of concern in the GSH. A total of 25 priority VEC linkages were identified from the baseline assessment as significant to address in scenario analysis or to consider in management recommendations. Fourteen of these linkages and impacts relate in some way, either positively or negatively, to activities associated with gas development and various aspects of the natural, social, and economic environment. The key VEC linkages and impacts include the following:

- Employment in the primary sector dominates the region, more so than many other rural areas of Saskatchewan. Activities associated with gas exploration and development are a significant source of secondary employment in the region, either in the form of wages from gas industry employment or from revenue generated from gas wells on ranchers’ properties. Approximately 40% of baseline social survey participants report having some form of secondary income or direct employment from the gas industry.
- Gas exploration and development is a major economic land use within the broader GSH region. The market value of over \$500 million annually (exclusive of government revenues, at fall 2006 prices) suggests that gas development may contribute to the economic prosperity of the region.
- Gas exploration and development has not contributed significantly to human population stability in the Study Area RMs. Notwithstanding expansion in gas activity since 1980, the regional population has continued to decline. No significant long-term correlation exists between levels

or distribution of gas development and population change. Gas development, and its current pattern of hiring and investment, is apparently not a sufficient activity to maintain population or recover declining population.

- The regional population decline is attributed primarily to the loss of youth in search of education, income, and employment opportunities not currently available in the GSH. Overall, employment within the region is down over the last 25 years. There are no direct policies or programs in the Study Area to address population decline, nor are there regional or local policies or programs to support income and employment diversification.
- Some gas exploration and development industry firms have invested in excess of \$171 million in the GSH region in land acquisition, bonuses, and infrastructure development. However, the firms that are the infrastructure investors are extra-regional, many of them extra-provincial, with much of the capital, profits, labour, and materials coming from outside the region. The result is a large investment, but little long-term financial benefits accrue to the people of the GSH.
- Gas exploration and development is seen as contributing positively to social conditions in the GSH through generating tax revenues to RMs and land owners, providing employment opportunities, and funding community activities. Gas development is also seen as negatively affecting social conditions through negative impacts on quality of life and deterioration of highway/road infrastructure by use of heavy equipment.
- Gas exploration and development, specifically drilling gas wells, has a short-term requirement for surface water resources. The water is typically taken from a landowner's dugout or slough. While isolated incidents of gas contamination of water sources have been reported due to pipeline leaks, there is no evidence of significant, adverse effects on the supply or quality of water for drilling. However, industry initiatives to manage impacts on water quality are largely self-regulated, and provincial and regional policies are perceived as either lacking or not sufficiently enforced at the local level.
- Although expansion of gas exploration and development is largely supported by social survey participants, there is widespread, local public

perception that the GSH area is being affected adversely from road development, chemical spills, and damage to species habitat due to gas activity.

- Gas exploration and development, when considered cumulatively with associated roads and trails, negatively affects land cover and biodiversity, measured in part by focal species occurrence. The exceptions are disturbance-obligate focal species or those whose natural distribution is found primarily within gas-disturbed areas. Range health decreases near gas disturbance sites. However, the impact on land cover is less than that of cattle watering holes.
- Environmental assessment of gas exploration and development activities is a concern. The industry is relied on to implement and monitor best management practices. There is a noted dissatisfaction with governance, particularly the corporate capital tax, among oil and gas producers, and concern with regard to constraints to maximizing gas development.
- The coordination and complexity of governance and land-use regulations and policies are of concern. RM bylaws often reflect provincial policy, but they are not always consistent. Responsibilities over decision-making concerning land use and access are fragmented and sometimes contradictory. An overriding concern is the need for clear designation, zoning, and management of competing lands uses.
- The GSH are of significant cultural and spiritual significance to both the Treaty 4 and Treaty 7 First Nations, and they are concerned over the disturbance and removal of artifacts. Gas exploration and development is perceived as negatively affecting First Nations cultural and spiritual values of the GSH. An indefinite moratorium on gas development is called for by elders of both Treaty 4 (File Hills Qu'Appelle) and Treaty 7 (Blood Tribe).
- Current land cover in the GSH is considered an important source of medicines by First Nations. First Nations elders perceive development in the GSH to negatively affect medicine sources and the biodiversity of the region, and call for enhanced levels and scope of protection, particularly in current ES1 zoned areas.
- There are more than 200 heritage resource sites of archaeological significance within the GSH Review Area. These sites are most often

discovered through the process of gas development. Gas exploration and development activities, including well pads and pipelines, have significant adverse impacts on heritage resources in terms of archaeological site disturbance.

- Terrain sensitivity models indicate that the topography and landscape within the GSH are highly sensitive to current anthropogenic disturbance. Disturbance is greater adjacent to livestock watering holes. On the other hand, recent research indicates no soils highly sensitive to acid deposition in the GSH.

- Land cover and water resources have a limited carrying capacity, and local perception and understanding suggest that ranching activity is not likely to increase significantly beyond current conditions.

- Governance issues in the GSH are related to the complexity and coordination of legislation first, and gaps or omissions in the legislation second. Information exchange among government departments needs improvement, especially regarding the sharing of ecological data. There is also an overall lack of enforcement mechanisms for environmental and regulatory violations and limited government coordination of efforts for data collection and monitoring for biodiversity protection.

- The current governance framework and land tenure for the GSH is perceived by First Nations as unduly restricting their access to traditional lands. First Nations currently do not see themselves as adequately represented in decision-making concerning GSH land use and future management.

SCENARIOS

As part of the baseline assessment of natural capital, we used the site-selection algorithm, MARXAN, to highlight biodiversity hotspots and other areas of conservation importance within the GSH Review Area. MARXAN minimizes the total “cost” of a potential reserve design by identifying the smallest overall area needed to meet planning goals and by selecting planning units that are clustered rather than dispersed. In the scenario analysis phase, we used results from MARXAN to identify “core biodiversity areas,” which were incorporated into the preferred scenario.

Roads and trails are a reasonable surrogate for anthropogenic surface disturbance in the GSH because

they are used for most human activities. We stratified the GSH into a “highly-developed” area that contains substantial road and trail footprints and a “less-developed” area with fewer roads and trails. On average the GSH has approximately 1.5 km/km² of roads/trails. We defined highly-developed areas as those having at least 1.9 km/km² (average density plus 0.5 standard deviation) and less-developed areas as having less than 1.9 km/km². We restricted MARXAN analyses for selection of core biodiversity areas to the less developed zone, because this area is relatively more pristine and will be more practical to maintain in a condition of high ecological integrity.

Final biodiversity features targeted in MARXAN site-selection analyses included: 1) seven focal species of plants and birds from an identified grassland guild; 2) four focal species that were independent of other species; 3) absence of two non-native species; and 4) Sharp-tailed Grouse leks. We varied planning goals (i.e., the percent of a species, predicted suitable habitat included within a reserve design) according to global and provincial species status and rarity within the GSH. Although our site-selection exercises were restricted to the less-developed areas, we set goals based on habitat availability across the entire GSH, forcing MARXAN to meet those goals in the less-developed zone. We explored goal sets that varied from 20% to 65% averages, with subsequent discussions determining that the 30% goal be used, since it provided the clearest delineation of discrete core biodiversity areas.

We assessed trends in surface disturbances from 1979 to 2005 for three anthropogenic disturbances: 1) roads/trails; 2) gas well surface leases (i.e., well pads); and 3) livestock watering holes. Annual rates of change were determined from past trends and used to guide spatial modelling of future scenario landscapes in the year 2020. Our three scenarios varied in intensity and location of gas development and livestock watering holes. One of the three scenarios is the preferred scenario that minimizes human impacts on core biodiversity areas. We summarized current and future levels of gas well pads, roads/trails, and livestock watering holes, as well as changes to range health and two focal species (beaked annual skeleton-weed and the non-native crested wheatgrass), for each of 37 identified core biodiversity areas. Vulnerability of each core biodiversity area was ranked based on potential increases in surface disturbance from each scenario, i.e., potential changes in density of well pads, roads/trails, and livestock watering holes, as well as percent change in focal species habitat. Those core biodiversity areas with the

greatest increase in surface disturbance were ranked as highly vulnerable, whereas those areas with low or even no change in surface disturbances were ranked low. In contrast, focal species vulnerability ranks were based on changes in habitat distribution, with those areas seeing the greatest loss of native species or gains in non-native species ranked as most vulnerable. Vulnerability ranks were used to summarize threats for core areas and prioritize conservation needs.

The three alternative future scenarios were defined as follows:

- Scenario 1: development of proven and probable gas reserves (2P); well spacing of up to 8 wells per section and up to 8 well pad surface leases/section; roads to each well pad; no new restrictions on livestock grazing; no new reserves or wetland protection.
- Scenario 2: development of proven, probable, and possible gas reserves (3P); well spacing of up to 8 wells per section and up to 8 well pad surface leases/section; otherwise same as Scenario 1.
- Scenario 3 (preferred scenario): 2P gas development, well spacing of up to 8 wells per section but only up to 2 well pad surface leases/section; new conservation protection or ecological reserves established in “core biodiversity areas”; new gas well drilling and both mineral and surface leases limited (see below) and no new watering holes in core biodiversity areas; wetlands protected.

From a 2005 baseline of 1,463 surface leases (1,559 gas wells), we projected an additional 1,446 well pads by 2020 (96/yr) for scenario 1 and 1,887 well pads by 2020 (126/yr) for scenario 2. Estimates were conservative because spatial simulations restricted future gas development from the RAER. Regardless of restriction due to RAER status, rates of gas development were forecast approximately twice (96–126 well pads/yr) that of historic trends (53–54 well pads/yr). (Note: the Recommendations section of this Executive Summary and Part 4 of this report presents our recommended specific conditions for uses of core biodiversity areas.) With those conditions within the core biodiversity areas and holding maximum well-pad density at 2 per section outside of core biodiversity areas, the preferred scenario resulted in a total of 309 new well pads. Although this represents a substantial reduction (21 well pads/yr) from baseline conditions (96–126 well pads/yr), directional or slant drilling from multi-well sites could be used to offset losses by maintaining a well density of up to 8 per section (i.e., 3 directional or slant wells per

vertical well) outside of proposed core biodiversity areas (see Recommendations).

Based on simulations exploring road and trail development at four densities, we estimated that, on average, 420 m (3.8 km/mi² of total roads/trails) of additional road would be needed to establish each well pad, 1020 m (4.4 km/mi²) for 2 well pads/section, 1,710 m (5.1 km/mi²) for 4 well pads/section, and 2,980 m (6.3 km/mi²) for 8 well pads/section. Locating well pads along existing roads with only short spur roads could substantially reduce total road development.

From a 2005 baseline of 3,175 km of roads and trails, we projected an additional 624 km of new roads to access well pads in scenario 1 and 814 km of new roads to access well pads in scenario 2. Annual rate of increase in kilometres of road was approximately twice that of historic (1979–2005) baseline rates, which would be necessary to match forecasted rates of increase in gas wells. Because new roads were modeled as a function of modeled locations of new gas well pads, the regions of the Review Area that saw the greatest increase in roads were the west, central, south, and northwest areas. By reducing gas development within core biodiversity areas and holding maximum well-pad density at 2 per section outside of core biodiversity areas, the preferred scenario resulted in a total of only 110 km of new roads. This represented an increase of 7 km/yr, a substantially lower rate of increase than baseline scenarios of 42 and 54 km/yr.

From a 2005 baseline of 507 livestock watering holes, we projected an additional 75 water holes (5/yr) by the year 2020 for scenarios 1 and 2. Locations of future watering holes were assumed to be available for areas further than 1,200 m from existing watering holes. We predicted that the “healthy” class of range health would decline for 6.2% and 7.3% of the landscape for scenarios 1 and 2, respectively, while the “healthy, but with problems” category would increase over 5.1% of the landscape for scenario 1 and 5.9% of the landscape for scenario 2. We predicted that “unhealthy” conditions would increase in baseline scenarios 1 and 2 by an additional 1.2% and 1.4% of the landscape, respectively. In contrast to the more ubiquitous distribution of new watering sites in the two baseline scenarios, the preferred scenario excluded watering holes from core biodiversity areas, resulting in a reduction of 24 watering holes or a total of 51 new sites. This represented an average increase of 3.4 new watering holes/yr from a baseline rate of 5/yr without considering core biodiversity areas. We predicted range health conditions in the Review Area under the preferred 2020 scenario as 50.9%

“healthy,” 44.1% “healthy, but with problems,” and the remaining 5% of the landscape as “unhealthy.” Compared to range health conditions estimated for the 1979 landscape and those predicted for 2005, the preferred scenario reduced trends in degradation of range health, while both of the baseline scenarios were projected to increase degradation of range health.

For the two focal species we selected as primary indicators in scenario assessments—crested wheatgrass and beaked annual skeleton-weed—future landscapes showed continued loss of the rare native beaked annual skeleton-weed and an expansion in the distribution of the exotic plant, crested wheatgrass. Differences among scenarios suggested substantial benefits of the preferred scenario, whereas differences between scenarios 1 and 2 were marginal, with scenario 1’s lower rate of anthropogenic disturbance resulting in slightly greater extent in beaked annual skeleton-weed and a smaller extent in crested wheatgrass. Scenario 1 and the preferred scenario resulted in a reduction in the rate of loss for beaked annual skeleton-weed and a gain in crested wheatgrass when compared to past trends. Further conservation action along with restoration and management, which were not considered in any of our scenarios, could potentially reverse negative trends and, for example, result in gains in habitat for beaked annual skeleton-weed and a reduction in the extent of crested wheatgrass.

When considering all species used in MARXAN site selection, the core biodiversity area with the highest biodiversity rank was an area in the southeast in an arm of the Review Area that contains a glacial tunnel valley complex. The presence of this geologically unique feature of the environment and associated high levels of biodiversity suggest that protection of this area is critical to the natural capital of the GSH. The RAER had a low overall biodiversity ranking, although this partly reflected our selection of focal grassland species that were not already well represented in the RAER. As we did not conduct field work in wetlands due to time constraints, or model wetland species and habitats, conservation ranks for some small wetland-based core biodiversity areas may be artificially low.

All conservation and sustainable development plans have costs as well as benefits. Whereas the benefits of conservation have been often difficult to quantify, costs can be summarized more readily in economic terms. The opportunity cost of implementing our preferred scenario includes, most prominently, a reduction in revenues from gas development, since we are recommending limited gas development in the identified core biodiversity areas.

Our economic analysis of the opportunity costs associated with implementation of the preferred scenario shows that the costs would be considerable, but slightly less than the costs already associated with designation of the current RAER. The total opportunity cost of implementing the preferred scenario, considering gas development alone, is approximately \$32 million in lost revenues to Government (i.e., royalties, corporate taxes, mineral lease rentals, and surface lease payments) plus an additional \$53 million in contributions to the local economy over the period of 2007–2021.

RECOMMENDATIONS

The recommendations presented in this RES report (see Part 4) focus on sustaining the ecological integrity of the Great Sand Hills and are grounded in the ecological realities of natural, human, and economic capital for the GSH region. Our methods focused on integrating biodiversity information in strategic environmental assessment on landscape and regional scales.

Governance and Institutional Arrangements

Existing institutional arrangements in the GSH region are not as effective as they should be. Information exchange among government departments needs improvement, especially regarding the sharing of ecological data. There is a need to establish a greater consensus and a clearer vision amongst government departments and agencies about the nature of and need for activities and land uses that are consistent with the principles of sustainability, and to communicate this vision to GSH stakeholders and First Nations. From our discussions with stakeholders and First Nations, there is considerable recognition of potential land-use conflicts and the need to resolve differences before they escalate to nonproductive or destructive levels.

Both the provincial government and the GSH Planning District Commission have generally been able to adapt to the demands of managing the GSH in the last 10 years, particularly in terms of promoting environmentally-sensitive development, but efforts are hampered by shortages of staff and other resources. Capacity building, both in terms of human development and physical infrastructure, is needed in the GSH region. At present, the lack of financial, human, and infrastructure resources combined with a lack of baseline data limits the overall effectiveness of governance and the scope of viable management options.

Two common issues were raised by stakeholders and

First Nations with respect to legislation affecting governance in the GSH. First, the scope of the legislation is inadequate to address the current mix of land uses and interests in the region. This is sometimes due to outdated legislation or legislation that has been conceived too narrowly to cover the range of relevant issues encountered in current management, as is the case with *The Provincial Lands Act*. Second, legislation and management mechanisms lack sufficient enforcement, making it difficult for responsible authorities to prevent or curb undesirable activity.

At present, government is criticized by the gas industry for failing to provide a clear and timely development approvals process, a situation that can be attributed partly to the controlling influence of the RMs. There is also confusion around the purpose and powers of the GSH Planning District Commission, and a strong call to amalgamate the bylaws of RMs, coordinate the mandates of government departments, and simplify the development process in the GSH. The most common suggestion to improve governance is to establish a central, higher-level governing body with decision-making power, supported by an effective and balanced network of interests focused on long-range planning.

Environmental Assessment

The environmental assessment (EA) program in Saskatchewan has been in existence since the mid 1970s. Legislation formalizing what had been learned in practice was put in place in 1980 with the creation of *The Environmental Assessment Act*. In the spirit of strategic environmental assessment, this Regional Environmental Study (RES) of the GSH focused on understanding the environmental limitations and opportunities for development in this ecologically sensitive area. The Scientific Advisory Committee (SAC) believes that such regional landscape-based approaches will help Saskatchewan realize its vision for sustainability, by providing insight into the complex nature of development decisions and integrating ecological and socio-cultural interests with the desire for economic development before irreversible decisions and actions are taken.

Nonetheless, the SAC's review of the assessment process and its historical application in the GSH revealed some serious concerns. Our concerns lie not within the Act itself, but in the changing way that the Act has been applied over the last 20 years, especially with respect to cumulative environmental effects. For example, in the GSH as each gas development project came on stream, the proponents were not required, as

part of their EA, to consider their impacts as additive to those of other projects already approved. The SAC believes that it is imperative that this trend be reversed.

We summarize our detailed recommendations as follows:

Specific Recommendations: Reserve Area (Core Biodiversity Areas)

- The current level and distribution of protection of biodiversity in the GSH is inadequate. In order to represent viable examples of grassland vegetation and associated focal species habitat, additional areas in the south and west of the Review Area require protection. We recommend that all 35 sites identified as core biodiversity areas in this study be provided a level of protection equal to that of the current Representative Area Ecological Reserve.
- The Saskatchewan Government should pursue avenues to achieve Ecological Reserve designation for core biodiversity areas using appropriate means, including but not limited to mineral rights buy-backs and land trades.
- Until such time as an Ecological Reserve designation is achieved, those areas should receive elevated statutory conservation protection so as to be protected from further surface disturbance and should be immediately subject to the following conditions: 1) no new mineral or surface leases are allocated; 2) existing leases are grandfathered; 3) no more than one gas well pad per section is permitted; 4) where gas development has already occurred, any new development must occur on existing well pads; 5) no further development of roads; 6) activities will be conducted only within the confines of existing pads, roads, and trails; 7) reclamation and monitoring are applied to the highest practical standard; 6) ranching operations are allowed only to the extent that they support and do not compromise the maintenance of the natural ecological system and its components.
- Saskatchewan Environment (SE) in consultation with other provincial government departments, Rural Municipalities, First Nations and local leases should, as quickly as practical, develop and implement a land management plan for the Representative Areas Ecological Reserve and the 35 core biodiversity areas in the Review Area.

Specific Recommendations: Non-Reserve Areas

- New well pads, watering holes, and associated roads/trails in the Non-Reserve Area of the Review Area should be restricted according to ecological information.

Specific Recommendations: Land-use Zoning

- The boundaries of ES1 and ES2 zoning designations should be altered to correspond with the boundaries identified in this study for Reserve and Non-Reserve Areas, respectively.

Specific Recommendations: Fire Ecology

- Government should take the lead role in introducing fire to the landscape with a pilot fire education program to show fire as a natural process and to show producers how the introduction of controlled fire can promote range health. We recommend continued experimentation with prescribed fire as a means of restoring and maintaining range health in the GSH. We also recommend that a programme be established to compensate local ranchers to conduct prescribed burning to reduce encroachment of shrubby vegetation in grasslands. This programme could be funded by government, ENGOs, and other private donors.

Specific Recommendations: Wide-ranging Species

- Key species were not considered in this Regional Environmental Study, because data were inadequate to consider them rigorously, including wide-ranging mammals that require vast areas larger than the GSH to maintain viable populations. Among these species is the pronghorn antelope. We recommend that research be undertaken to better understand the requirements of wide-ranging species, such as pronghorn antelope, that use the GSH on a permanent or seasonal basis.

Specific Recommendations: Surveys and Databases

- We recommend increased funding of Saskatchewan Conservation Data Centre (CDC) to support sufficient staffing for maintaining up-to-date, high-quality, and relevant databases.
- Ord's kangaroo rat has not been systematically

surveyed in the GSH. We recommend surveys of sites predicted to support this species, recording presence or absence, updating habitat models, and protecting sites with confirmed occupancy. Additional systematic surveys of non-habitat should be considered to ensure accuracy of predictions of non-habitat.

- An organized inventory and ongoing monitoring of wetlands in the GSH is needed.

Specific Recommendations: Communications Plan

- We recommend a communication plan for landowners and lessees through a partnership of government (local and provincial), industry, and academia that highlights best management practices for biophysical surveys and a permitting plan for research activity on leased land.

Specific Recommendations: Governance

- The Province of Saskatchewan should define its provincial interests in the GSH and take responsibility to ensure that rules, regulations, and policies of the Rural Municipalities in the GSH are consistent with the province's rules and regulations concerning land management in the area.
- The SAC strongly endorses the need for Government, in consultation with stakeholders and First Nations, to find effective mechanisms for the early resolution of land-use conflicts. Government should promote the joint participation of different stakeholders and First Nations in the decision-making processes in regard to the GSH as a way to identify different interests and promote consensus.
- The various roles of government departments and agencies in planning and decision-making in the GSH, as well as current legislation and land-use plans, need to be clarified to all stakeholders. We recommend strengthening the character and mandate of the Great Sand Hills Planning District Commission to play a more direct, and centralized role in land-use planning, regulation, and decision-making in the Great Sand Hills. Among our specific recommendations is for the Commission to adopt the structure of a corporate board with governance and management responsibilities and decision-making authority.
- A follow-up mechanism for reviewing best management practices should be established for

the GSH through the GSH Planning District Commission. Environmental monitors should be responsible to the local municipalities through the Commission. The Commission itself should employ a full-time senior Environmental Manager to oversee environmental monitoring activities and auditing of best management practices in the GSH. The position would be funded jointly by the provincial government and the Commission membership. The Environmental Manager should have the mandate to review industry and government environmental monitoring data and programs in the GSH, and to release to the public an annual follow-up report that documents the “state of best management practice compliance and performance” in the GSH.

- A centralized information/resource system should be established to house annual monitoring reports, industry EPPs, RM bylaws, regulations, and community economic profiles and investment/infrastructure profiles concerning the GSH region. This information would be housed and managed by the GSH Planning District Commission, and made available to its members and to outside parties as determined appropriate by the Commission.

- We recommend that the GSH Planning District Commission receive a sustained funding commitment, the balance of which is sourced by the provincial government. Such funding would be directed toward: 1) a paid Executive Secretary position for the Commission; 2) a paid Environmental Monitor Coordinator position for the Commission; 3) funding long-term ecological monitoring and data sharing; and 4) meeting regular Commission operating costs. Special funding arrangements also should be established on a cost-shared basis with the RMs, industry, and other members as appropriate, to support Commission special research initiatives, monitoring, and development projects.

Specific Recommendations: Acts and Regulations

- The final report and recommendations of the GSH RES should be subjected to a full review pursuant to *The Environmental Assessment (EA) Act*. The body and recommendations of the RES report should contribute to the scientific foundation of an eventual Regional Sustainability Plan focused

on the maintenance of ecological integrity within the GSH.

- The EA process should be modified to include consideration of the cumulative effects of all land-use projects in order that a more realistic assessment of the impacts of human activities on the ecological capacity of GSH can be determined.

- The SAC recommends that further guidance and decision support criteria be developed for determining “development” under section 2(d) of *The Environmental Assessment Act*.

- The SAC identified a number of concerns and recommendations in relation to monitoring gas activities and associated best management practices in the GSH. For those gas development activities that do trigger the full environmental impact assessment process under section 2(d) of *The Environmental Assessment Act*, a formal post-approval follow-up mechanism is necessary. The objectives for a follow-up program under the Act should be to: 1) verify that proposed environmental and socioeconomic mitigation measures have been implemented; 2) verify that implemented impact mitigation measures are working as intended; 3) verify the accuracy of project impact predictions; and 4) identify and manage unanticipated environmental and socioeconomic impacts.

- Government should review the purpose and effectiveness of the current *Provincial Lands Act* and revise, replace, or update the Act to address current land activities in the GSH and new interests on Crown land.

- Both government agencies and First Nations are concerned that while *The Heritage Property Act* is successful in the protection of “built heritage,” there is inadequate attention to the designation and protection of heritage properties based on aesthetic or First Nations’ spiritual or cultural values. *The Heritage Property Act* should be amended to clearly provide for the protection of heritage sites based on aesthetic and cultural grounds, and ensure that joint management of such resources occurs, where applicable, with the affected First Nations.

Specific Recommendations: Reducing Impacts

- Gas mineral lease holders should be required to use directional/slant drilled wells. Specifically,

multi-well pads with directional/slant drilled wells or a combination of directional/slant drilled wells with a vertical well on the same pad are recommended.

- Given the sensitive nature of soils in the GSH Review Area, and the serious threat of non-native plant species invasion, it is critical that areas subject to human-caused surface disturbance or exotic plant species invasion undergo reclamation back to a near-native state in a timely fashion. We support the employment of permanent environmental monitors to identify areas for surface reclamation and for special management of non-native plant invasion. A reclamation fund should be created to ensure that proper reclamation activities take place, even if original stakeholders no longer operate in the area. This fund should also support reclamation research projects. Reclamation activities should be overseen by a joint partnership between industry, agriculture, a revitalized Great Sand Hills Planning District Commission, the RMs, the lessees, and the Province.

- Measures capable of decreasing the surface impacts of gas industry activity on the sensitive environment of the GSH and surrounding areas should be examined and put into practice. All relevant technologies toward that end should be employed, and new practices and methods with a high potential to contribute to the reduction of surface disturbances should be investigated.

- In order to maintain an environmentally sound ranching industry, best management practices for range management (including water management) must be consistently implemented by ranchers. The provincial government has an important role to play in working with ranchers to develop, communicate, and assist in implementing best management practices.

- An improved and more transparent process is needed for management of incidents that impact negatively upon the environment during construction, operation, and decommissioning of any development on the land (e.g., distributed water systems, gas wells). Affected RMs and landowners/lessees should be involved with full regard to the constraints of due process.

- Before the approval and construction of any new distributed watering systems in the Review Area, the proponent should make a request to Saskatchewan Agriculture and Food (SAF) and

SE. Provincial agencies should provide assistance with location preference and gathering of information on rare and endangered species.

- An environmental assessment process should be required prior to installing distributed watering systems. Overall grazing pressure should be controlled in areas receiving distributed water, such as by use of management-intensive grazing, rotational grazing, or rest-rotation grazing, in order to maintain range health. We also recommend intensive monitoring of the overall and cumulative effects of distributed water systems on the GSH ecosystem. Research and monitoring of distributed watering systems is necessary to make valid predictions about long-term impacts on range health, invasive plants, and sensitive focal species.

- We recommend that fragmentation of natural habitats in the GSH by roads, trails, pipelines, and other linear disturbances be controlled and ultimately reduced, accompanied by intensive monitoring of ecological impacts. Specifically, we recommend a combined approach in which no new roads or other surface disturbance are allowed in the Reserve Area (i.e., existing RAER and 35 new core biodiversity areas), and that best management practices are applied and monitored in the Non-Reserve Area across the GSH Review Area. We also recommend quantification of the use of roads as part of the ongoing monitoring of and adaptive management within the GSH. Management actions that limit road development, both in the form of new conservation areas and best management practices, are likely to have the greatest impact on conserving the biological resources of the GSH.

Specific Recommendations: Monitoring

- Within one year of the date of this report, an ongoing environmental monitoring program for the GSH should be designed and implemented.

- Monitoring efforts to date within the Review Area have been fragmentary, inadequate, and primarily focused on the specific activities of gas projects, such as well drilling. To build and maintain the GSH environmental monitoring program, partnerships should be established, first between the primary users (government, industry, agriculture, NGOs) of the area and then with external sources of monitoring expertise,

such as the Alberta Biodiversity Monitoring Program.

- A monitoring program should, as a minimum, include the following features: 1) coarse and fine filter monitoring approaches; 2) standardized protocols and rigorous design; 3) centralized monitoring metadata and data storage and access, including data held by industry; 4) dedicated environmental monitors; 5) mandatory cradle-to-grave project monitoring; 6) continued research on response of species to gas development.

Specific Recommendations: Reclamation

- Within one year of the date of this report and in order to reflect the latest techniques available, we recommend that the Saskatchewan Government establish an inclusive review process of existing reclamation guidelines that involves appropriate government agencies, industry representatives, stakeholders, First Nations, and industry.
- To ensure the restoration of land subject to surface disturbances irrespective of their cause, we recommend that a reclamation fund be established in the same manner as that proposed for environmental monitoring in the Review Area.
- The Orphan Wells Program needs to be supplemented to cover the broader reclamation of surface disturbances not associated with gas development, including the elimination of pockets of invasive, non-native plant species before they become widely established. As with monitoring, the responsibility for such funding should come from all parties creating surface disturbance; however, the government must take the lead role and allocate for this purpose some of the revenues (e.g. gas royalties, taxes, surface lease payments) generated from the Review Area.
- Environmental monitors (as identified in earlier recommendations) should be used to survey the GSH area for areas requiring surface reclamation or management of non-native plant species invasion; these monitors should also track the progress of reclamation projects.
- We recommend extensive conservation, restoration, and management activities in the GSH, including reclamation of gas line routes and abandoned roads and well pads, as well as eradication of non-native plants wherever feasible.
- Many areas of disturbed soil within the GSH

require restoration. Our models suggest that appropriate management and restoration could lead to gains in habitat.

- Only locally adapted native seed sources should be used for reclamation; all seed sources must be carefully scrutinized for contamination by unwanted plant species.

Specific Recommendations:

Sustaining Regional Communities and Economies

- We recommend that Saskatchewan Agriculture and Food re-evaluate the amount of compensation to agriculture leaseholders for gas surface leases in the Review Area. We suggest that Government look to other jurisdictions for potential examples of more equitable crown lessee compensation policies for gas well pad surface leases.
- We recommend Government consultation with First Nations as part of the GSH RES implementation strategy, and that the consultation processes adopt the principles outlined in *The Government of Saskatchewan Guidelines for Consultation with First Nations and Métis People: a Guide for Decision Makers*.
- We urge that consultation for RES implementation include both Saskatchewan First Nations interests and the interests of the Blackfoot Confederacy of Alberta, who claim the GSH as their traditional territory and as an area of contemporary cultural and spiritual significance.
- To facilitate ongoing consultation and knowledge sharing post-RES implementation, we recommend the establishment of a “Council of Elders and Traditionalists,” with whom governments and industry would be able to consult to ensure that proper protocols are followed with regard to issues of development, land use, land access, and heritage resource management, and to ensure that the sacred nature of the GSH is properly addressed.
- Ceremonial sites of particular interest to First Nations should be identified as part of the RES implementation process, based on consultation with Treaty Four and Treaty Seven members or the Councils of Elders and Traditionalists.
- The immediate purpose of First Nations access to the GSH is to engage in spiritual and cultural activities, such as ceremonies and the collection of medicinal plants. Although the SAC cannot

recommend access to particular areas, as many are potentially subject to a Crown lessee agreeing to such access, every consideration should be extended to permit First Nations access to land within the GSH for spiritual ceremonies and medicinal plant collection. First Nations membership on the GSH Planning District Commission could facilitate such negotiations.

- A protocol should be established between industry, government, and First Nations concerning the treatment of disturbed heritage sites.
- We recommend that the Government of Saskatchewan, through Regional Economic and Cooperative Development (RECD) in partnership with the local Regional Economic Development Authorities (REDAs) and Western Economic Diversification (WED), develop a series of information sessions, mailings to businesses, and workshops, detailing the specific application procedures and success strategies for Provincial, REDA, and WED programs and initiatives, be offered to the employers of the region. In addition, we recommend that a partnership of government agencies (RECD, REDA, and WED) develop a close working relationship with the GSH Planning District Commission to improve program uptake and increase local adoption of the various labour and employment programs.
- We recommend that the Government of Saskatchewan, through Saskatchewan Finance, grant business tax relief for 3 years to those businesses that are provided provincial or federal support through labour and employment programs and provide new employment opportunities. A progressive income tax structure for new employment also should be created. For those RMs that have indices of economic specialization above 50, for every new job created outside the sector of concentration, an income tax credit of 10% of gross earnings should be provided to each new employee for the first 5 years of employment.
- We recommend that the Government of Saskatchewan, through Saskatchewan Finance, establish a property tax break for 3 years for individuals who are new “non-traditional” sector employees, if during their 5 years of income tax credits for employment in the region (based on the above recommendation), they purchase a new home or a home 20% more expensive than their previous (owned) dwelling.
- The Government of Saskatchewan, through

RECD, Saskatchewan Finance, and in partnership with the GSH region banks and credit unions, should establish business loans for those businesses outside the dominant economic sectors (agriculture and gas extraction) with below prime interest rates for new operations/divisions/ventures that support value added services to the dominant sectors.

- The Government of Saskatchewan, through Saskatchewan Finance, should eliminate corporate taxes for the first 10 years of operations for new businesses in the GSH region, followed by a reduced corporate tax rate (for example, from 42% to 30%). This reduction of tax rates should provide incentives to locate businesses not in the major population centres, but in smaller communities.
- We recommend that the Government of Saskatchewan, through RECD and in conjunction with information sessions from economic development agencies such as WED and the REDA, provide educational workshops to help small manufacturers develop business plans and marketing strategies.
- To further facilitate economies of scale, we recommend that the Government of Saskatchewan, in partnership with the GSH Planning District Commission, create a Great Sand Hills Manufacturers Alliance (GSHMA). The GSHMA would serve as an intermediary between local firms and the gas sector or other large potential contract providers.
- We recommend that Saskatchewan Environment in consultation with other provincial government departments, RMs, and local lessees, implement improved education in best management practices for ranchers.
- We recommend that dedicated environmental monitoring officers be hired for the region with a special focus on members of the ranching communities. These monitoring officers would conduct various environmental surveys (water quality, invasive plants, soils, etc.), monitor the application and use of best management practices in the region, and conduct educational workshops.
- We recommend that one-time baseline assessments of water quantity and quality be established as soon as possible, and that ongoing water quality and quantity comparisons throughout the region be conducted by the environmental monitors. A water quantity and

quality assessment and statement should be completed prior to any on-site gas development.

- The Government of Saskatchewan, through Saskatchewan Tourism, Saskatchewan Transportation, the Southwest Saskatchewan Tourism Association, the local communities, and the GSHDPC, should create a coordinated and integrated regional tourism plan built upon the foundations of ecologically sensitive tourism and recognition of the economic, social, and historical forces that shape the region, past and present. A historical route, complete with cairns, roadside pullouts, and stops at the various museums, is appropriate for the region.

- The Government of Saskatchewan, through RECD, should develop and implement a “hire local, buy local” policy for gas firms operating in Saskatchewan, and develop a local industry capability assessment framework (similar to the assessment from HRSDC for skilled foreign workers). The GHSPDC and the newly proposed GHSMA would serve as intermediaries facilitating dialogue between the gas industry and local manufacturers.

- We recommend that the Government of Saskatchewan, through SE and under the auspices and direct assessment of the environmental monitors proposed herein, require that “environmental performance bonds” be posted by all gas companies operating in the GSH Study Area. The bond can be cashed in the event of a leak, seep,

blow-out, water contamination, or other form of environmental disturbance, to pay for immediate remediation efforts. The bonds may also serve to provide income loss payments to lessees when remediation takes productive land/water out of operational use.

- The SAC recommends that the Government of Saskatchewan, through SIR, conduct a comprehensive assessment of current and projected gas reserves and their economic valuations every 3–4 years.

CONCLUDING COMMENTS

The Great Sand Hills Scientific Advisory Committee has given careful consideration to issues of ecological integrity of the Great Sand Hills and to the situation faced by local communities. The recommendations of the SAC are designed to contribute towards a sustainable future for the GSH and its communities using a balanced approach founded on principles of sustainable development. Our recommendations are based upon our scientific studies of the past two years and our assessment of past studies and plans for the GSH. All of our recommendations are consistent with our preferred sustainability scenario. We suggest that our recommendations, and the studies on which they are based, be considered in their entirety as an integrated package serving the needs of regional communities and the people of Saskatchewan.