

Redberry Lake Biosphere Reserve Periodic Review

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On behalf of the Canadian Commission for UNESCO

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1.0 PREAMBLE

The site visit for this periodic review was conducted from July 6 - July 8, 2010. Our main areas of inquiry focused on activities the Biosphere Reserve participated in over the period since 2000, how the Biosphere Reserve evolved since designation and potential future initiatives. We were hosted by John Kindrachuk, Executive Director of the Redberry Lake Biosphere Reserve Association (RBLBRA) and toured his farm operation. We stayed with Board member Andrew Hawyrsh and toured his farm operation. The majority of our review inquiries occurred at the Redberry Lake Biosphere Reserve Research and Education Centre located in the Redberry Lake Regional Park. We also participated in an extensive tour of the Biosphere Reserve with John Kindrachuk and Andrew Hawrysh. Our main information collection activity involved a focus group session with the entire RBLBRA Board including: Larry Hawyrsh (Chair), Robert Shay (Secretary - Appointed by Town of Hafford), Stan Novicki (Treasurer – appointed to focus on UNESCO - Culture), Diane Hawrysh (Director – appointed to focus on UNESCO - Education), Peter Kingsmill (Director - Mayor of Hafford), Andrew Hawrysh (Director - Appointed by RM of Redberry), Victor Hupaelo (Director - Reeve for RM of Redberry), Nick Partyka (Director - Reeve for RM of Douglas), and Gary Nickel (Director - Reeve for RM of Great Bend). A kitchen table meeting was also held with three board members.

Additional background information necessary to understand the evolution of the Biosphere Reserve over the past ten years was gathered from websites, journal articles, and grey literature including background reports, brochures, and scientific reports (see reference list). We also met with Lenore Swystun of Prairie Wild Consulting. Prairie Wild is assisting the Biosphere Reserve with one of their ongoing projects focussed on regional planning. Initial results and recommendations were shared with the RBLBRA and discussed with John Kindrachuk and Larry Hawrysh.

Our review indicates that the Redberry Lake Biosphere Reserve is meeting the obligations of the UNESCO World Biosphere Reserve Program. The Biosphere Reserve is playing a critical role in demonstrating a viable and alternative approach to industrial agriculture in the region. The Biosphere Reserve has also moved to fill planning and management gaps created as governments have shifted or eliminated program activities in the region. Furthermore, the Biosphere Reserve is working to influence and improve regional land use planning, critical to ensuring sustainability into the future.

We express our appreciation for the logistical assistance provided to us by John Kindrachuk and Andrew Hawyrsh of the Redberry Lake Biosphere Reserve, and Dominique Potvin and H  l  ne Gaulin of the Canadian Commission for UNESCO. Thanks go to the RBLBRA Board and others we interviewed for the review. The authors also appreciate the thorough review provided by Sharmalene Mendis-Millard and additional information provided by Larry Hawyrsh to address review comments. Any errors or omissions in this report remain with the authors.

2.0 INTRODUCTION: REDBERRY LAKE BIOSPHERE RESERVE

The Redberry Lake Biosphere Reserve was designated in 2000 and this is the first periodic review. The Biosphere Reserve is located in the Province of Saskatchewan, Canada. The core area is that part of the Biosphere Reserve designated by the Government of Canada as a Migratory Bird Sanctuary including the Islands within Redberry Lake and the lake itself. The buffer zone consists of those lands placed under a zoning by-law by the Rural Municipality (RM) of Redberry to protect the core area from inappropriate development (e.g. subdivision development). The area of transition/cooperation is the watershed of Redberry Lake located within the RM of Redberry. The Redberry Lake watershed lies within the Saskatchewan River watershed but is self-contained and has no surface connection to the Saskatchewan River (UNESCO MAB Programme, 1998; Figure 1). No changes to the configuration of the Biosphere Reserve occurred over the past ten years; however, recommendations on changes to the Biosphere Reserve configuration are provided subsequently in this report based on our review (see section 7.0). A number of changes and updates to the information for the UNESCO/MAB Biosphere Reserve Directory are presented in Appendix 1.

The review consists of five main sections - significant changes in the biosphere during the past ten years; assessment and updates on the conservation function; assessment and updates on the sustainable development function; assessment and updates on the logistics function; and information on changes to governance and “civil society” context for the RBLBR. The review concludes with a series of suggestions.

3.0 SIGNIFICANT CHANGES IN THE BIOSPHERE RESERVE DURING THE PAST TEN YEARS

Narrative account of important changes in the local economy, landscapes or habitat use, and other related issues.

The local economy has been under significant pressure from global agricultural trends that have made it more difficult for family farm operations to survive. These trends continued throughout the period from 2000 to present placing pressure on farmers to increase the size of their operations. An analysis by the National Farmers Union in 2003 showed a steadily widening gap between gross and net income on farms. While gross income rose beginning in the 1970s through to the end of the study period in 2003, net farm income declined. This decline has been attributed to a rise in annual-crop input costs while the corresponding food commodity prices, set in international markets, have not kept pace with increased costs of production.

In making their personal choices on the farm, farmers are influenced by the knowledge that conditions, mostly weather-related, in some years allow them to achieve a decent income. For this reason, farmers on the prairies often refer to this uncertainty as ‘next-year’s country.’ Also, the allure of larger incomes and greater economies of scale leads to ever larger farm size, but also to other inefficiencies imposed by short good-weather windows in which to seed, spray and harvest (National Farmers Union, 2003). The above income shortfall has continued after 2003 to today.

There are also a number of positive economic signs in the farming economy in Saskatchewan. These generally come from an expanding organic food market, a rise in Farmers' Market outlets, and increasingly common linkages between producers and consumers and also local grocery stores (National Farmers Union, 2003). In or close to the RBLBR, there are farmers markets (Borden and Blaine) and farmers sell organic products e.g. hogs directly to consumers. Furthermore, many individuals living in the RBLBR have always grown their own "organic" produce and the Biosphere Reserve has plans, dependent on funding, to demonstrate how to grow organic produce in the Town of Hafford.

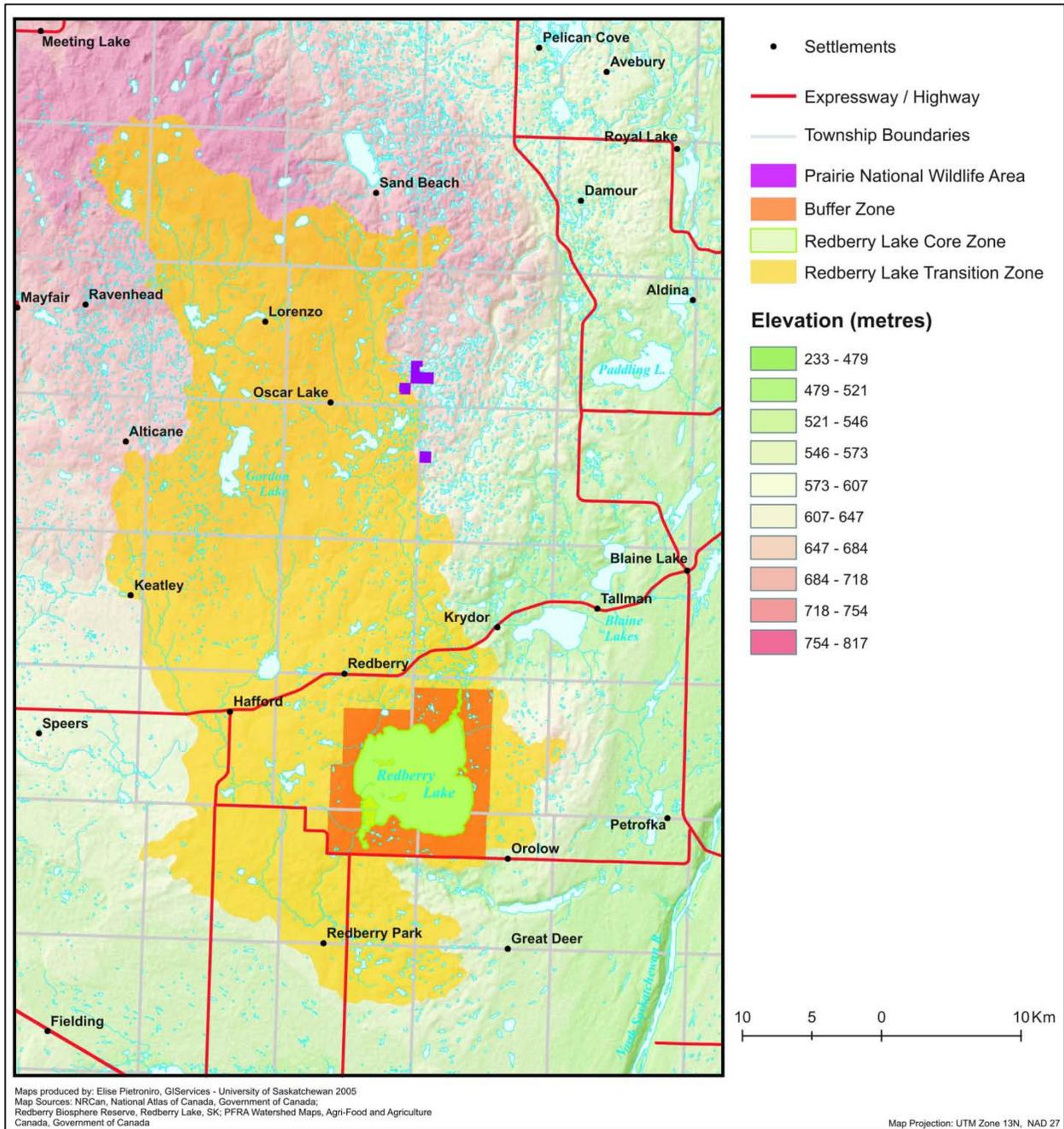


Figure 1. Location map of the Redberry Lake Biosphere Reserve identifying core, transition and buffer areas, along with elevation, settlements, and municipalities (Redberry Lake Biosphere Reserve, 2011).

The original Biosphere Reserve proposal was one of the local responses of community members to address concerns with the above described trend in agriculture. A significant visioning initiative was led by the RBLBRA through the development of a Cooperation Plan (Sian, 2002). The RBLBRA is led by the RBLBRA Board (see Preamble for members of the Board). There are no official “members” of the RBLBR Association. Sian conducted sustainability workshops and drew up a plan with good local input, participation and support, and wrote about the biosphere designation. Over the past ten years, the RBLBRA has led and delivered agricultural projects (e.g. AEGP project) that were successful in demonstrating an alternative agricultural approach based on grass fed beef production (discussed subsequently in sections 4.0, 5.0 and 7.0).

Other trends including government cutbacks to environmental and community development also had impacts over the last ten years. Although the basic structure of Federal, Provincial and municipal governance remain unchanged, government reduced their direct involvement in environmental activities such as monitoring (see section 4). By 2003, the Biosphere Reserve was forced to close its interpretive centre due to a lack of funding. These resource constraints resulted in fewer people volunteering and low morale (Mendis-Millard and Reed, 2007). Despite these funding constraints, the community’s resilience prevailed, leading the Biosphere Reserve to partner on research and increase awareness of the goals of the Biosphere Reserve. This led to new multi-year funding in support of Biosphere Reserve programming from the Provincial government (Mendis-Millard and Reed, 2007). The interpretation centre was subsequently renamed the Research and Education Centre and re-opened in 2005 with support from the Province of Saskatchewan funding. The Provincial government’s support recently ended in 2010 and the RBLBRA once again reduced the work carried out in the centre. Furthermore, the Biosphere Reserve was unable to continue paying for its coordinator. Mendis-Millard and Reed (2007) indicate that while funding does not ensure a Biosphere Reserve’s success, it certainly plays a role in enabling social capital and networking, key determinants to a successful Biosphere Reserve.

The Biosphere Reserve also successfully partnered with other community and provincial organizations. Specifically, the Association partnered with: the Saskatchewan Watershed Awareness Initiative (Watershed Awareness Initiative, no date); Redberry Watershed Agri-Environmental Group Plan and Canada-Saskatchewan Farm Stewardship Program (Redberry Lake Biosphere Reserve Association, undated-A); the Agri-environment Services Branch, Land and Infrastructure Resiliency Assessment Project (Land and Infrastructure Resiliency Assessment Project, no date); and additional RMs on regional land use planning activities (Prairie Wild, 2010). This partnering strategy produced significant results (discussed subsequently in sections 3.0, 4.0 and 5.0).

In summary, the main governance strategies over the past ten years that served the RBLBRA well included tapping into and building on strong communal relations, championing an alternative vision to industrial agriculture expressed through stewardship activities, a willingness to partner with community-based researchers, leveraging success by working with

partner organizations including government (Provincial government and non-governmental organizations) and delivering their relevant programs at the local level, and more recently embracing regional land use planning.

Human population of the biosphere reserve

The following population numbers were presented in the nomination document. The population in the core area was 0 in 1989. This has not changed. The population in the buffer area was estimated to be less than 50 permanent and less than 120 seasonal residents. Although there are no data on the buffer area at this time due to the boundary of the buffer area not aligning with Statistics Canada boundaries, the view among those participating in this review is that this has not changed significantly. In the transition area there were approximately 1050 and less than 50 seasonal residents in 1998 (UNESCO, 1998). The most recent census data available for the largest community in the Biosphere Reserve, Hafford, Saskatchewan is from 2006 and demonstrates a concern with population decline raised by the RLBRA Board. The population in 2006 was 360 down from 401 in 2001 representing a decline of 10.2 %. The population of the RM of Redberry (includes Hafford) was 451 in 2006 down from 461 in 2001 a decline of 2.2 %. These declines compare to the Province of Saskatchewan's population change in the same period which was -1.1% (968,157 in 2006 down from 978,933 in 2001 (Statistics Canada, 2011).

Most recent 30 year climate normals for weather stations in the Biosphere Reserve

Station: Borden 18N, Saskatchewan, Canada

Latitude: 52.6°; Longitude: -107.2°; Altitude 587.02m

Climate normals 1971-2000

Average temperature of the warmest month (degrees Celsius): 17.2

Average temperature of the coldest month (degrees Celsius): 17.0

Mean annual precipitation: 375.9mm (Environment Canada, 2011)

Continued local involvement of the work of a biosphere reserve association

Refer to sections 3.0, 4.0 and 5.0.

Appropriateness of the current zonations

Refer to sections 4.0 and 7.0

Continued justification for a biosphere reserve

Refer to sections 3.0, 4.0, 5.0, 6.0 and 7.0).

The biosphere reserve organization and/or biosphere reserve associated group(s). Comment on the following topics that are of special interest in the experience of the Canadian network.

Cooperation plan

Individual Cooperation Plans are developed by most Biosphere Reserves in Canada. Elements in the Plans reflect the three main functions of a Biosphere Reserve. With the success

of their Biosphere Reserve application, Redberry was able to mobilize existing social capital through established networks to hire a consultant to prepare the Redberry Lake Biosphere Reserve Cooperation Plan. Several community meetings were held to develop a vision for the Biosphere Reserve and plan for sustainability (Sian, 2002; Mendis-Millard and Reed, 2007). The Biosphere Reserve continues to be guided by this vision today. The Cooperation Plan is currently being updated through the regional land use planning project discussed subsequently in section 4.0 (Prairie Wild, 2010).

Budget and staff support including approximate average annual amounts (or range from year-to-year); main sources of funds; special capital funds (if applicable); number of full and/or part-time staff; in-kind contribution of staff, facilities or equipment; volunteer contributions of time or other support.

The overall budget for the RLBRA has fluctuated significantly over the 10 years mainly based on intermittent government support and the success/lack of success the Biosphere Reserve had in securing project dollars. The Research and Education Centre, a legacy of the Pelican Project converted for RLBRA use, has been closed once during the ten years and is currently only providing part-time services due to budget constraints. Operating costs for the Centre are approximately \$60K/year. There is currently an Executive Director working on a part-time basis at a cost of \$70K/year (salary/operations), hired in 2009 after two years of funding was provided to the Canadian Biosphere Reserves Association (CBRA) by Environment Canada to distribute among their member biosphere reserves. This funding will run out in 2013. Prior to that, staff consisted of student interns, on average three per year over the ten years, a consultant who worked on the Cooperation Plan (discussed previously; Sian, 2002), a coordinator hired in 2003 who worked on negotiating a grant from the Provincial government, an Executive Director/Coordinator hired in 2005 along with an Education Coordinator once the Provincial grant was secured. A new coordinator was hired in 2008-2010 and Executive Director in 2009. The Coordinator was released in 2010 due to Provincial funding cuts. The main funding for these positions were from the Province of Saskatchewan, in the order of \$50K per year from 2005-2010, and from the Federal Government, \$60K/year starting in 2008 and running through to 2013 (previously mentioned). The Biosphere Reserve had budgets over the past ten years in the range of \$2K- \$250K/year with significantly increased funding since 2005 – ranging from \$60-\$250K/year dependent. The Biosphere Reserve depends on a volunteer board of nine to carry out much of its work.

The biosphere reserve's communications strategy

The Executive Director of the RLBRA has considerable media experience and a very good understanding of how to communicate with the local community. The RLBRA has successfully reached out beyond its boundaries to its neighbours, as evidenced by the partnership project on regional land use planning with adjacent RMs (discussed subsequently in sections 4/0. 5.0 and 7.0). The Biosphere Reserve was also successful at communicating its activities and message during Canadian Biosphere Reserve Association Annual Meetings and had significant influence at the National level. The main message from the beginning was the need for Federal support, ultimately achieved in 2009. The RLBRA also hosted a Biosphere Reserve annual

meeting in 1999, the year before its designation, and again in 2006. The following is a listing of communication efforts:

Newsletter published monthly (when funding available; started regular publications in July 2008) reaching a target audience of 1200 community members.

- Website that contains information on the Biosphere Reserve along with up to date documents on a variety of subjects.
- Publishing a minimum of four articles per year in the local newspaper. Also TV and radio when opportunities arise.
- Preparation of brochures on specific topics such as trails (Redberry Lake Biosphere Reserve, undated-B), biological diversity of the lake (Redberry lake Biosphere Reserve, undated-A), Entry points for Educators (Redberry Lake Biosphere Reserve, undated-D), Redberry Lake Watershed Agri-Environmental Group Plan (Redberry Lake Biosphere Reserve, undated-C).
- Hosting on average four special events and activities associated with projects and planning to engage local residents. This has recently increased to five or six events.
- Educational interpretation of the Biosphere Reserve through sophisticated display and promotional material (developed 2005-2006) by the education coordinator at the Education and Research Centre. Promotional material included frisbees and t-shirts, and other items for sale.
- Writing special articles, approximately one/year, the most recent prepared by the current Executive Director available on line at <http://www.pcap-sk.org/docs/listitem182.pdf> (Kindrachuk, 2010).
- Communicating Biosphere Reserve activities through local municipal council committees
- Engaging volunteers (12-15 based on interest).

Strategies for fostering networks of cooperation in the biosphere reserve that serve as connections (“bridging”) among diverse groups in different sectors of the community (e.g. groups devoted to agricultural issues, local economic development, tourism, conservation of ecosystems, research and monitoring)

The RBLBRA has done an excellent job at partnering with a variety of organizations and initiatives, and as previously discussed, this strategy was essential to its success over the last ten years (refer to sections 3.0, 4.0 and 5.0 for additional information).

Particular vision and approaches adopted for addressing the socio-cultural context and role of a biosphere reserve

The RBLBRA developed a strong relationship with the University of Saskatchewan working on social-ecological research. For example, two related research projects, (Social Science and Humanities Research Council supported projects) examined community capacity building through research partnerships (Mendis-Millard and Reed, 2007) and uneven environmental management in Canada with the Redberry Lake region as a case study (Reed, 2007).

The RBLBRA also reached out to First Nations in the area to work on improving agricultural activities on reserve lands through partnership activities with the North Saskatchewan River Council in 2010, however, funding for the project has not been secured to date. The Association also met at least two times with the Lucky Man Band to discuss

agricultural practices in 2008 and 09. Although the Band is interested, the Band is dealing with other priorities at the present time.

Obstacles encountered by the biosphere reserve or challenges to its effective action

Three main obstacles have challenged the RBLBRA's effective action: inconsistent funding, government retreat from environmental planning and management, and a general lack of public understanding of the biosphere reserve concept. Inconsistent funding has led to intermittent problems with maintaining an operating presence in the education and outreach centre. Maintaining staff support was also a challenge. Funding is mainly tied to projects and, as with most community groups, project funding is difficult to secure on a consistent basis. The Federal government (Environment Canada) in 2008 provided 5 million dollars over five years to support Biosphere Reserves in Canada. With this recent funding, this issue may be partially addressed in the future if funding is extended beyond 2013. The general lack of public awareness and understanding of the biosphere reserve concept – especially prior to recent core funding, was a problem. Since core funding the RBLBRA has increased its communications activities (discussed above).

Reed (2007) discussed the problem of government retreat from environmental planning and management, and an associated problem of government and National ENGOs planning their activities at a regional scale without local input (i.e. Nature Conservancy of Canada and Ducks Unlimited). Although this latter issue was not raised by those interviewed for this review, Reed (2007) indicates that these issues lead to uneven environmental management across the country. Gaps in environmental management have emerged in the Redberry Lake area (e.g. monitoring, local economic development). Our review indicates that the Biosphere Reserve has played a critical and successful role in addressing some of these gaps (see sections 3.0, 4.0 and 5.0).

Effectiveness of management plans of government agencies and other organizations in the biosphere reserve. Brief note about plans that have been completed or revised in the past 10 years

The Canadian Wildlife Service reduced funding for long term monitoring of the Redberry Lake. This left a void that the RBLBRA has attempted to fill. This issue is highlighted through a letter written by Ray Alisaushas to Environment Canada on November 26, 2006. The letter highlights concerns about declining biodiversity and abundance in the migratory bird community breeding at Redberry Lake along with concerns that avian biodiversity has been compromised by populations of Gulls nesting on the islands in Redberry Lake. These species prey on many nesting birds and may contribute to declines in migratory bird populations. He indicates that action must be taken to reduce gull populations (Alisauskas, 2006: see entire letter presented in section 3.0).

This was an issue that the RBLBRA was concerned about due to increasing pressure on the ecosystem due to climate change. To address this issue, the Association partnered with Delta Waterfowl, an NGO, and have recently established a predation control program.

The RBLBRA recognized the need to improve regional land use planning (refer to section 4.0 for more detail). These regional land use planning activities are, in part, a response to potential future gas extraction in the region, a trend raised by the RBLBRA Board as a concern. Regional partners on the land use planning project include the RMs of Mayfield and Blaine, currently not within the Biosphere Reserve transition zone. First Nations with treaty entitlement lands are also participating. The regional land use planning initiative project suggests that further analysis on the boundaries of the Biosphere Reserve needs to be done. The transition/area of cooperation may need to be extended to include the additional RMs participating in the regional land use process if these participants are interested. The potential gains from extending the Biosphere boundaries should be explored (see section 7).

“Sustainability” as a deliberate guiding theme for programs in the biosphere reserve

The RBLBRA has done an exemplary job of focussing its activities on sustainability, in particular its work on providing and implementing an alternative vision to industrial agriculture. There was the early work already mentioned focused on developing a community plan for sustainability with short, medium and long-term goals and projects (Sian, 2002). Many farmers in the Biosphere Reserve have and are demonstrating a smaller scale practice of agriculture, based on sustainable use of native prairie for cattle production. These activities are yielding positive gains in the areas of environment, culture and society. This assertion is based on our discussions with the RBLBRA board, our observations of two farming operations during our review visit, and extensive field trip of the Biosphere Reserve. The environment is being protected through best management practices and gains in environmental services. Local farmers are demonstrating that the family farm is viable (Kindrachuk, 2010; Prairie Conservation Action Plan, undated).

Particular scientific work linked with national and international programs (e.g. EMAN, EuroMAB, IUCN – World Conservation Union)

The RBLBRA established a SI/MAB Forest Biodiversity monitoring plot, as have many Biosphere Reserves in Canada. The coordinating body for the SI/MAB Program in Canada was the Ecological Monitoring and Assessment Network (EMAN). Unfortunately, EMAN was disbanded by Environment Canada in 2007.

The RBLBRA hosted numerous interns from the University Pierre Mendes in Grenoble France since the early years of the Biosphere Reserve. The RBLBRA has an active partnership with the University working on issues related to environment and business. The Biosphere also has a partnership with the Rhön Biosphere Reserve in Germany that began in 2009. The goal of this agreement is to build capacity and exchange ideas, projects and strategies for sustainable development. Projects worked on/to be worked on include eco-tourism development, product labelling and branding, landscape conservation and land use; agriculture, organic farming and marketing, and national and international partnership development. The first project involved the development of a joint Brochure highlighting each Biosphere Reserve promoting a tourism exchange between people from each site (Kindrachuk, 2010).

Issues arising from multiple cross-scale relationships inherent in the social-ecological systems (e.g. forests, marine systems; links of key local corporations to global economy; government activities across different levels of federal, provincial, and local jurisdictions)

The two main issues already introduced and discussed in greater detail in sections 4 and 5 are the role the Biosphere Reserve is playing in demonstrating a viable alternative to industrial agriculture and engaging in regional land use planning to address, among other issues, potential negative effects from gas development in the region (see sections 3.0 and 4.0).

Strengthening collective capacities for the overall governance of the biosphere reserve (e.g. organization of new networks of cooperation, partnerships)

The Biosphere Reserve's governance arrangements are working well. Much of the RBLBRA Board's representation is from municipal councils within the Biosphere, providing access to local decision-making and enabling projects such as the regional land use planning initiative. The RBLBRA also partnered with other organizations successfully leveraging support for projects that meet Biosphere Reserve goals in the area of wildlife management and stewardship (see sections 3.0 and 4.0). In March 2011, a SSHRC-funded partnership and networking project led by Dr. Maureen Reed and Marc-André Guertin of CBRA was announced that aims to strengthen capacity at the national level among biosphere reserves and academics.

4.0 THE CONSERVATION FUNCTION

Significant changes (if any) in the main habitat types identified for the biosphere reserve, including natural processes or events, main human impacts, and/or relevant management practices.

There have been no significant changes in the main habitat types for the Biosphere. There are gaps in monitoring capacity due to government cutbacks. This gap is a concern especially in light of lowering water levels, increasing salinity of the Redberry Lake and impacts on wildlife.

Recent data on lake water levels, recorded by the Saskatchewan Watershed Authority shows continuing changes in the lake's water volume, as measured in water elevation above sea level (Figure 2). The declining water reached its lowest point in 2004 and has been rising since then. The water-level changes at Redberry Lake are 'big-picture' changes and are difficult to understand in detail or to make predictions. Other saline lakes in Saskatchewan have also lost water levels (e.g. Gooseberry, Manito and Big Quill lakes) but not all have (e.g. Wakaw Lake). Some Saskatchewan lakes have gained water (Lenore Lake; Hammer 1990). It is a truism, especially in ecology, to say that factors rarely act in isolation from one another. Still, these changes should be monitored and adaptively responded to where possible (Canadian Water Resources Association and Saskatchewan Network of Watershed Stewards 2003). Various conservation measures as supported by Canada's Environmental Farm Planning are useful in this regard (see below).

The few studies of the chemistry of Redberry Lake's water that have been conducted suggest that the lake's water comes from both above (surface runoff) and below ground aquifers (e.g. Schmutz 1999). This is consistent with the general ecological concept of the 'water cycle.' Surface runoff has been affected since settlement by a variety of land use factors with complex outcomes, including: 1) drainage of lakes and marshes that allows water to leave a landscape before it could evaporate to make more rain or infiltrate into ground, 2) a change in snow melt and evaporation on exposed soil, and 3) the construction of many small stock-watering dams preventing water from reaching creeks to fill lakes.

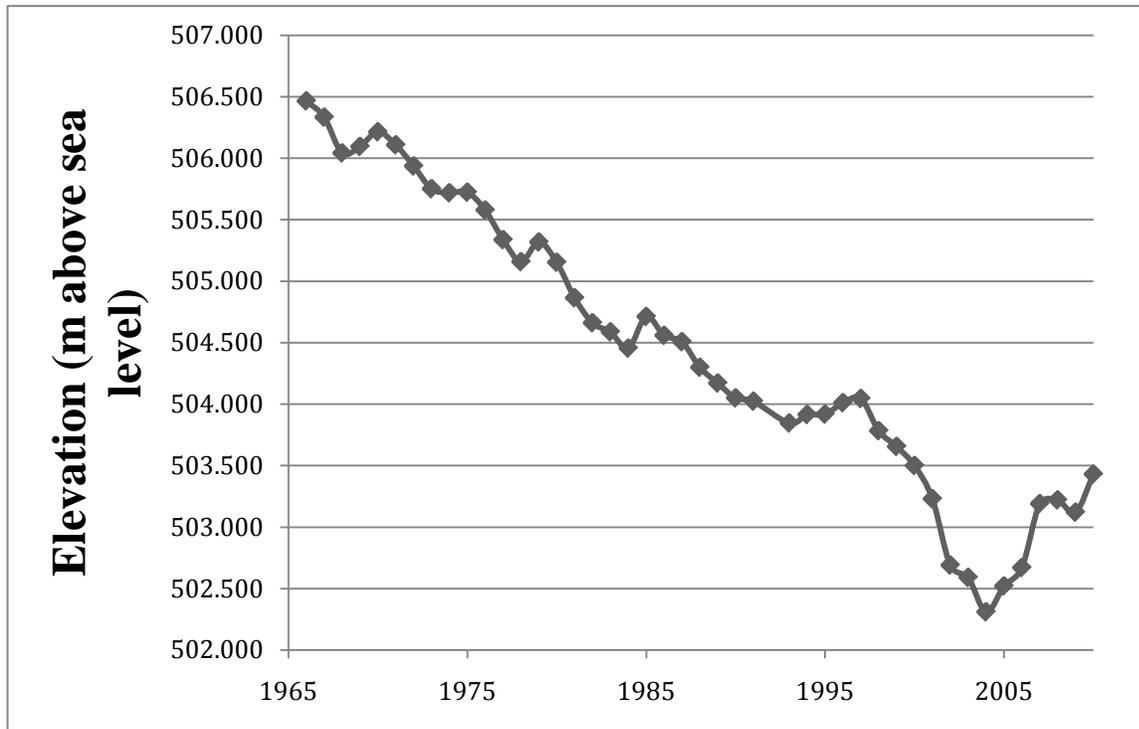


Figure 2. Changes in Redberry Lake's water levels from 1966-2010. The levels are peak levels, which occurred in the months from April to November. Data are from the Redberry Lake monitoring station and compiled by Saskatchewan Watershed Authority.

Ground water aquifers may have been altered by: 1) water wells and increased extraction of ground water for human, agricultural and industrial uses, 2) by reducing ground water recharge via altered evaporation regimes and via drainage as mentioned above, and 3) by puncturing the clay layer below aquifers when aquifers were deemed to produce below the desired Litres per minute allowing shallow aquifers to drain lower. These factors would affect shallow aquifers more so or more quickly.

By reducing water volume in shallow aquifers, water seepage or springs would become less common or have reduced flow. A drying / loss of springs is part of local knowledge that has been reported by rural Saskatchewan residents (see also Biological Survey of Canada 1990). Shallow aquifers are typically recharged each spring by waters from snowmelt and spring rains, while deep aquifers are recharged from shallower and possibly distant aquifers above them and

with a delay in time (e.g. van der Kamp and Maathuis 1991). These factors are plausible and may have contributed to the declining water levels in Redberry Lake over time.

In addition to the pressures on Redberry Lake's waters outlined above, industrial users tend to extract large amounts of water. The oil and gas extraction industry uses water, returns used water underground and potentially stresses aquifers in a practice called 'fracking' or the hydraulic fracturing of bedrock to help liberate natural gas from gas pockets (BCTWA 2011). As oil and gas resources become scarcer under a peak oil scenario (Mauger 2009), exploration pressures rise, smaller reserves tend to be developed and more techniques are drawn into service to extract gas otherwise locked in pockets, as in 'fracking'. There is a need for rural people and all citizens to ensure that extraction is not so hasty and ill-conceived as to cause damage which rural residents are the first to experience and forced to live with, in the long run (e.g. Kossowan 2004). Planning should be in place to manage industrial water uses (Briere 2004) to minimize the cumulative effects of many stressors (Schindler 2001, Partners FOR 2009; refer to section 4 and 5 for a discussion of regional land use planning efforts in the Redberry Lake area).

While Redberry Lake's beauty in every season of the year remains untarnished, some of the ecological processes are altered and there are signs that some members of its wildlife community are not faring well. Since 2000, studies of white-winged scoters have continued, examining nesting ecology, brood rearing and heavy metal contamination in the duck's blood stream.

Redberry Lake's islands remain the key nesting locations for scoters. In 2000-01, 198 nests were located on the three islands, and only 1 nest along the lake's shores where areas roughly 10x the size of the islands were searched. This combined with data on nesting success favouring concealed over more exposed nests suggests that avoiding aerial and ground predators is an important factor in the duck's life cycle (Alisauskas et al. 2010).

Given the need for concealment and protection on islands, the lowered water levels in recent years have made the nesting ducks more vulnerable. The island that once was and that is now a promontory of the mainland, Old Tern Peninsula, supported only 7 nests in 2000-01 (Traylor et al. 2004).

The number of scoter nests found has fluctuated over the years but a substantial decline in scoter numbers during the past decade is evident (Figure 2). Counts of nests and counts of pairs on the water (see Figure 3) show a similar pattern of decline, amounting to only 65% now in comparison to breeding pairs counted two decades ago. Causes of the decline are clearly varied and include predation on duckling by gulls lowering the rate at which ducklings survive and return to breed later. Also predation by mammals is taking a toll. In 2010, red foxes were found on Gull Island in mid-summer and a coyote den was located on Pelican Island (Alisauskas et al. 2010).

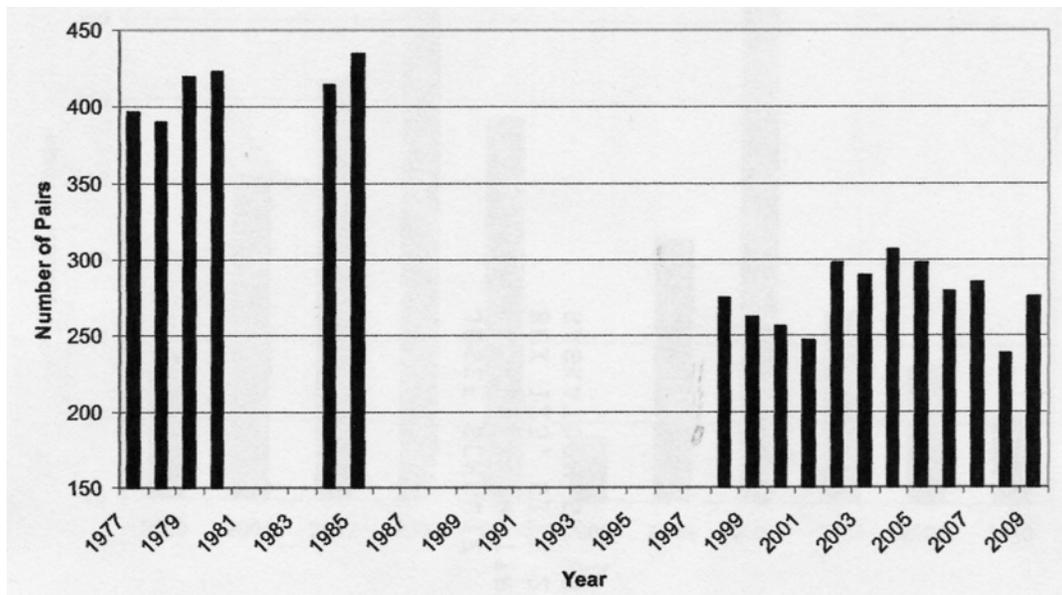


Figure 3 Number of breeding pairs of white-winged scoters counted at Redberry Lake, 1977-2010. From Alisauskas et al. 2010

Declines in white-winged scoter populations have been noted range wide, so that conditions at Redberry Lake do not alone account for this dilemma. Spring counts from the air indicate that all three scoter species in North America have declined to approximately 45% of 1940s levels, with half of that decline having occurred during the last two decades. Factors implicated in these regional declines include the ducks eating contaminated zebra mussels, human disturbance and habitat loss (Traylor et al. 2004).

Studies of heavy metal in blood samples of female white-winged scoters nesting at Redberry Lake showed that cadmium, lead, selenium and mercury was present at low levels in all females sampled, as might be expected. Even with the presence of higher concentrations in some females, the researchers concluded that the females’ survival as measured by return rates the following year was not affected by heavy metal concentration (Wayland et al. 2007, 2008).

Considering these ongoing pressures at Redberry Lake and recommending more hands-on management, Ray Alisauskas et al. wrote on 26 November 2006 to Phil Taylor, Wildlife Biologist, Environment Canada, the following letter:

We are writing to highlight concerns about reduced biodiversity and abundance in the migratory bird community breeding at Redberry Lake. As you are aware, Redberry Lake is a Federal Migratory Bird Sanctuary, Provincial Wildlife Refuge and Biosphere Reserve. The Redberry Lake Sanctuary and to a lesser degree the Biosphere Reserve were established to enhance and protect species of migratory birds, but we believe that avian biodiversity has been compromised by large populations of California and Ring-billed Gulls nesting on the islands of Redberry Lake. These species exert heavy predation pressure on many nesting birds and may have been responsible for declines in abundance of many migratory birds that historically bred in this area in larger numbers.

Redberry Lake is a world-renowned area important for migratory bird conservation and has been designated as an Important Bird Area (IBA). The IBA designation came about because (1) the lake is used by large concentrations of birds, (2) populations of some of these species are at risk, and (3) the lake represents an intact and unique ecosystem. Redberry Lake is an important site for the conservation of over

180 avian species, including nine endangered, threatened, or rare species. It is our contention that increased gull populations have eliminated breeding populations of several species and severely compromised the value of the lake to others. For example, the endangered Piping Plover formerly bred on the shores of the lake and islands. There were 41 individuals counted in 1984, 21 in 1991, 4 in 1996, and none seen in 2006. The common tern formerly bred on several islands in the lake. Populations in the mid 1980's were in the low thousands. Apparently, terns have not bred at Redberry Lake in the past 9 seasons. The lake also supports the largest known breeding concentration of white-winged scoters in North America. In recent history, scoter populations have endured a significant decline; breeding pair counts on Redberry Lake have declined by ~55% in the last twenty years alone. The value of Redberry Lake persists for the white pelican. Nest numbers have steadily increased since reaching an all time low in 1976 (i.e., 70 nests) and were at the highest levels recorded in 2006 (1300 nests).

As many species have declined, both California and Ring-billed Gull populations at Redberry Lake, have grown. In 1996, there were 2,394 and 10,519 breeding pairs, respectively, of California and Ring-billed gulls nesting on the islands within the lake, while in 1985 there were only 2700 nests counted for both species combined. Further, gull populations in Canadian Prairie Parkland have grown 11% since 1967, likely a result of increased agriculture and landfills during the past century.

Predation of nests and young of scoters, terns and plovers has been documented at Redberry. Gull predation has been known to have detrimental impacts on populations of these and other avian species elsewhere. It is our contention that increased abundance of gulls at Redberry Lake threatens the existence of other breeding bird populations, especially local populations of Piping plovers, white-winged scoters, and a myriad of other shorebirds and waterfowl. For example, in a recent study, gull predation rendered survival of white-winged scoter ducklings to < 1% in 2000 and 2001. Thus, in addition to scoters, we suspect high gull predation overwhelms the potential for recruitment of locally produced birds including piping plover, phalarope, killdeer, lesser scaup, mallard, gadwall, northern pintail, and the area may currently function as an ecological trap for many species. We doubt that the initial motivation behind the establishment of Redberry Lake as a Migratory Bird Sanctuary was to effectively establish such an ecological trap.

In our view, direct control of breeding gull populations at Redberry Lake is required to maintain this area as an IBA for birds other than white pelicans. Culling of adults, habitat alteration, the use of pyrotechnics and other scaring devices are not recommended. Instead, egg removal from gull nests in early-May will induce nest failure and prevent recruitment. Resulting failed nesters may disperse from the lake, and may immediately reduce predation pressure on nesting migratory birds and their offspring. Such management action should be repeated in sequential years, and accompanied by an assessment of changes in numbers of gull nests, as well as species that have declined because of high gull populations. Such an assessment is necessary to guide decisions about how long such management should proceed.

Whereas gulls are likely responsible for large-scale alteration of breeding waterbird community at this Migratory Bird Sanctuary over the last 2-3 decades, the goal of this proposed action is to increase avian biodiversity as well as abundance of many species at this unique site. Future findings from white-winged scoter research should help guide decisions about local predator management (specifically red fox, ring-billed gull and California gull), but a sanctuary-wide survey done by Kerbes and Howard (1986) should be repeated periodically to evaluate management actions. We firmly believe direct action must be implemented to reduce gull populations if Redberry Lake is to retain its function as an Important Bird Area.

Recently, John Kindrachuk, Executive Director of the Biosphere discussed the challenges of increased predation by mammalian predators at Redberry Lake with representatives of Delta Waterfowl Foundation Inc. Delta Waterfowl's mission statement is "Delta provides knowledge, leaders and science-based solutions that efficiently conserve waterfowl and secure the future for waterfowl hunting" (Delta Waterfowl Foundation, 2010).

Given the low water levels at Redberry Lake, mammalian predators are able to walk or wade to 'islands' and this is of special concern. This concern may be for the short or medium term only, as one hopes, water levels may continue to rise (Figure 1) and allow the lake to perform the full ecological function it once had. Delta Waterfowl has traditionally employed

predator control among other means to improve nesting success among waterfowl. Management of mammalian predators, to be most effective, was designed in accordance with data from studies on which type of predator, where and over what time period they should be removed (e.g. Sargeant et al. 1995). Côté and Sutherland (1997) have reviewed 20 published studies and also concluded that when predators were removed the hatching success and harvestable surplus of target bird populations did increase. However, this increase was local and temporary and did not have an enhancing effect for the total population overall because of a population's intrinsic population regulation mechanisms that reflect all conditions and not just predation in an ecosystem. Thus, any plan to remove predators at Redberry Lake should be carefully considered.

Predator management at Redberry Lake could meet with opposition given the multi-use philosophy and varied background of visitors, and stakeholders. Education and planning might be called for to achieve buy-in, especially considering the dubious practices of predator controls, informed by "good animal / bad animal" viewpoints of the past (e.g. Hooey 1948). Modern views on predators are cognizant of a stabilizing role of predators. This stabilization rests on the recognition of a 'predator cascade' where larger predators exert predation pressure and thus some level of 'control' on smaller predators. Studies have shown that functional food chains acting within predator species and across predators and prey can have a stabilizing influence not only on the animal community but throughout an ecosystem (e.g. Stolzenburg 2008).

Salt-containing water bodies, like Redberry Lake, occur on every continent. Globally, the volume of salt lakes compared to freshwater lakes is about equal (Hammer 1986). Salt lakes can be very productive at low or moderate salt concentrations. Redberry Lake has a high salt content (total dissolved solids 20.9 g/L) and ranks low in its biological production because of its salt concentration but also due to low nutrients (Robarts et al. 1992, 1999). The decline in Redberry Lake's water levels has been recognized for decades. This decline, and a concomitant increase in the water's salinity, has far-reaching implications for the aquatic community, many of which have been recognized (Tumber et al. 1993, Evans et al. 1996).

Redberry Lake is not alone in having an altered water balance where evaporation exceeds annual water input from above and below ground. Saskatchewan's other large, shallow, saline lakes (Quill, Old Wives and Manito lakes) show a similar pattern. Here evaporation of water leaves the salt behind, lowering water volume and raising salt content per unit volume. Hammer (1990) attributed an increase in salinity from 14 g/L in 1970 to 24 g/L in 1988 to the decline in Redberry Lake's water volume.

Salt water has a desiccating effect on the cells of living organisms. Different organisms have physiological adaptations that allow them to cope with more or less salt in water. These adaptations are evolutionary outcomes and not flexible or able to change in an organism's lifetime. Hence, some species once common at Redberry Lake have disappeared early in the sequence such as northern pike (Figure 4). Later, a commercial fishery that once sustained local livelihoods to 1980 had to be abandoned as whitefish suffered from increased salinity. In the 1990s, Brook stickleback was common, which is a salt-tolerant fish that also exists in the brackish waters of river-ocean estuaries. As water volume continued to decline and salinity rose, the fishes' food was at risk with one of three species of *Daphnia* (water fleas) being threatened.

The expected impact of increased salinity on species is not all or none. Hammer (1990) reports that whitefish and walleye do not reproduce in saline waters, but can grow well in them up to a point if food is abundant.

After 2000, personnel from the National Water Research Institute at Saskatoon were transferred out of Western Region and research activity declined. Now, 10 years later, a broad-spectrum monitoring of the lake's biodiversity and ecological health should be encouraged (See Section 7.0 for our recommendation on this matter).

In addition to affecting aquatic plant and animal physiology, salinity also affects physical properties in the ecosystem. Asking the question of how salinity might affect the water's power in filtering solar radiation, Michael Arts and others have studied ultraviolet light in the 280-400 nm range (Arts et al. 2000). The researchers found that life-damaging UV rays penetrated deeper in the saline waters than freshwater. This level of penetration is influenced by the system's productivity reflected in its dissolved organic carbon content and also the wind's mixing powers moving the carbon to various depths. This illustrates a complex interaction that could become more influential to life in the lake as salinity increases.

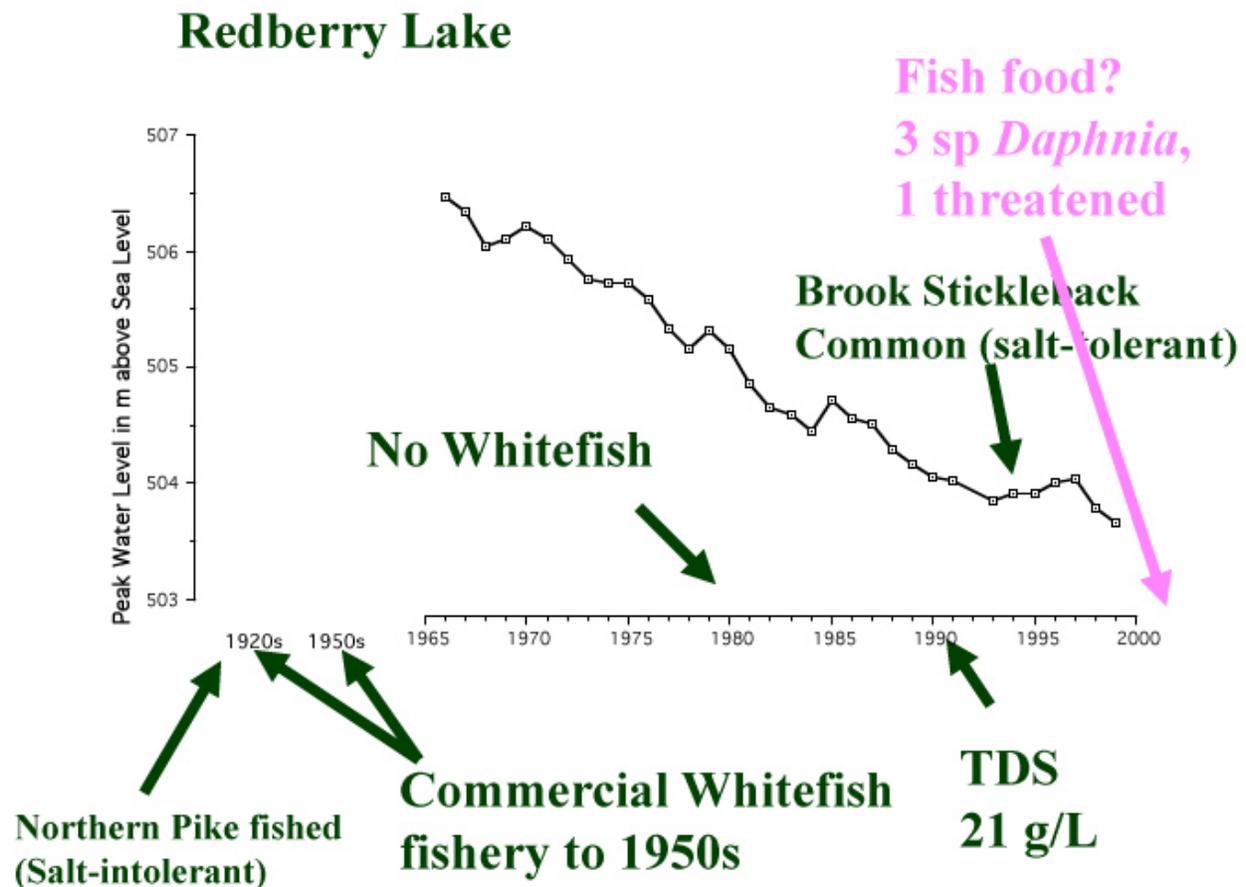


Figure 4. Trends in Redberry Lake water levels (metres above sea level), are shown over time. Events that can be logically linked to declining water levels coupled with increasing salinity are also shown. Source: J.K. Schmutz unpublished.

Like the vertebrates that feed on them, the microscopic plants and animals in the Redberry Lake's water column have their own forces to contend with. For example, Tumber, et al. (1993) studied the abundance of bacteria in Redberry Lake including many bacteria which capture the sun's energy and are an important first step in a lake's food chain. Bacterial abundance was examined in relation to water depth, temperature, dissolved organic carbon and nutrients (phosphorus and nitrogen). One interesting result was that when large-celled bacteria existed there tended to be more ciliates, which are also microscopic organisms that feed on bacteria and other aquatic organisms. The precise reason for this was unclear, but it could have been that the ciliate predator kept other predators of bacteria low in numbers allowing the bacteria to grow larger; or, the bacteria grew large for some other favourable reason and the ciliates simply responded to this availability of preferred prey.

The above noted impacts to the core of the Biosphere Reserve and pull-back of government from monitoring is of concern to the RLBRA. The RLBRA indicates ongoing commitment to working collaboratively with both the Canadian Wildlife Service and NGOs to re-engage in a comprehensive monitoring of the core zone of the Biosphere (see Section 7).

Describe the main conservation programs that have been conducted in the biosphere reserve during the past ten years as well as current on-going ones. Note their main goals and the scope of activities, e.g. biotic inventories, species-at-risk, landscape analyses, conservation stewardship actions. Cross reference with other Sections below where appropriate.

The Saskatchewan Wildlife Federation's Habitat Trust lands program protects many thousands of hectares across Saskatchewan including the northern, primarily parkland habitat portion, of the Redberry Lake watershed (Saskatchewan Wildlife Federation, 2011). This program is ongoing. The lands provide habitat for wildlife and access to local residents and visitors for recreation. Grazing of cattle is employed strategically, to enhance biodiversity by preventing the encroachment of aspen into prairie remnants. Grazing also slows tree growth within aspen groves and helps maintain a diverse herbaceous-plant understory by slowing the trend for the tree canopy to close. Historically this habitat-patch diversity was maintained in prairie and parkland habitat by recurring fires and grazing by bison.

Ducks Unlimited Canada is active in the pothole portions of the watershed, particularly northwest, working with landowners to provide dense nesting cover for waterfowl. Cutting of hay land is managed so that cutting occurs late enough in the nesting season to allow eggs to hatch and for the broods to move to the many permanent and semi-permanent ponds in the area. This habitat management enhances not only waterfowl but also other ground nesting birds and other wildlife. Delta Waterfowl is currently working with the Biosphere Reserve on potential predation control measures for Redberry Lake (see discussion above).

The Biosphere Reserve is a partner in the Prairie Conservation Action Plan that has five priority areas – connecting people to native prairie; sustainable land uses and development implementing and promoting best management practices, planning processes, policies for conservation and sustainable use of native prairie; managing invasive plants; valuing ecological goods and services provided by native prairie ecosystems and accounting for them in decision-making; and grazing management in prairie ecosystems (Prairie Conservation Action Plan, no

date). The Biosphere is active in delivering through the Redberry Lake Watershed Agri-Environmental Group Plan beneficial management practices on farms (i.e. water well management, relocating livestock confinement away from stream banks and lakeshores, fencing modifications for watering management and control of invasive plants, promoting portable winter feeding away from the yard site and to protect sensitive areas control of farmyard runoff, grassing waterways, planting riparian buffers, improving stream crossings, establishing native pastures, woodlands, slough and pothole areas and shelterbelt establishment) (Redberry Lake Biosphere Reserve Association, no date).

The RBLBRA is also working through the Land and Infrastructure Resiliency Project to develop and apply a standardized cost/benefit assessment tool to help decision-makers address climate change impacts associated with extreme rainfall events (Kindrachuk, 2010;). The Biosphere just learned funding of \$200,000K will be made available, much of it for a pilot project in the Biosphere. The pilot site will be selected summer 2011.

5.0 THE SUSTAINABLE DEVELOPMENT FUNCTION

Briefly describe the prevailing trends over the past decade in each main sector of the economic base of the biosphere reserve, e.g. agriculture, renewable resources, non-renewable resources, manufacturing and construction, tourism and other service industries etc.

Refer to Section 2.

Community economic development initiatives. Programs to promote comprehensive strategies for economic innovation, change, and adaptation, and the extent to which they are being implemented within the biosphere reserve. Local business or other economic development initiatives. Are there specific “green” alternatives being undertaken to address sustainability issues? Relationships (if any) among these different activities.

The Biosphere Reserve is actively working on three new fronts to foster economic and human development which is socio-culturally and ecologically sustainable. The first is demonstrating the emerging alternative to industrial agriculture through sustainable uses of native prairie (Prairie Conservation Action Plan, no date; see section 3.0). Secondly, the Biosphere Reserve is involved in the Land and Infrastructure Resiliency Assessment (LIRA) Project promoted by the Saskatchewan Government designed to address, through a standardized cost/benefit assessment tool, climate change induced rainfall events that can cause flooding and damage agricultural and rural infrastructure (see discussion above). The third front involves an ambitious project to improve regional planning (Prairie Wild, 2010). This effort is being driven, in part, by the emerging potential for gas extraction in the area (see discussion of fracking in Section 3 for potential impacts). The regional land use planning initiative will build on the Redberry Lake Biosphere Reserve: A community’s plan for sustainability [Cooperation Plan] (Sian, 2002), translating the Plan into actionable activities. The effort is participatory involving Rural Municipalities (RMs) that are adjacent to the Biosphere Reserve area of cooperation including the RMs of Mayfield and Blaine Lake. Activities will/have involved mapping the communities’ current condition and future vision with associated policies to enhance and

improve land use, recreation, heritage, green space, facilities, and environmental stewardship (Prairie Wild, 2010).

The Biosphere Reserve also intends to develop a branding program with assistance from the Rhön Biosphere Reserve in Germany, one of their international partner Biosphere Reserves.

Community support facilities and services. Programs in/for the biosphere reserve that address issues such as job preparation and skills training.

The RBLBRA supported four graduate students over the past ten years working on issues including: exploring the meanings and cultural landscapes of elder residents in Redberry (Everts 2008); community capacity for ecosystem management (Mendis-Millard, 2004); and ecological services provided by farmers and ranchers in the Redberry Lake Biosphere Reserve (Bonnell & Garrigou, 2002). The RLBRA also collaborated with Dr. Maureen Reed's graduate classes from the University of Saskatchewan identified as Geography 480 from 2003.

Summer jobs were available at the Research and Education Centre for students working on interpretation. During periods of funding, upwards of five students each year worked on a rotational basis at the Centre.

6.0 THE LOGISTICS FUNCTION

Describe the main research institutions in the biosphere reserve, or conducting work in the biosphere reserve, and their programs. Comment on organizational changes (if any) in these institutions over the past ten years as they relate to their work in the biosphere reserve. Summarize the main themes of research and monitoring undertaken over the past ten years under the general categories of transdisciplinary syntheses (research and scholarship), and for topics that come under the standard abiotic, biotic, and socio-economic categories. List specific topics with reference citations under these headings, and provide a list of the full citations alphabetically by lead author at the end of Section 5, or in a separate Appendix.

The Redberry Lake Biosphere Reserve is a member of the Canadian Biosphere Research Network. The Network's purpose is to "connect people who are interested in biosphere reserve research ranging from work done ON the biosphere reserve concept and its implementation (e.g., what is its significance and what are the practical applications of the concept?) to work done IN biosphere reserves relating to conservation, sustainable development and livelihoods and capacity building" (Canadian Biosphere Research Network, 2011). The network aims to facilitate connections among researchers conducting on a variety of topics important to Canadian biosphere reserves - interdisciplinary, biotic, abiotic and social – and those from government agencies, biosphere reserves, non-governmental organizations, and the Canadian Biosphere Reserves Association.

The RBLBRA partnered with the University of Saskatchewan School of Environment and Sustainability and previously with the Department of Geography – both through Dr. Maureen Reed - to provide research projects for students. Founded in July 2007, the School of Environment and Sustainability is an interdisciplinary graduate school at the University of

Saskatchewan. The School delivers master's and doctoral programs which emphasize the integrative nature of environmental challenges and the benefit of interdisciplinary understandings. The RBLBRA is involved in a six-credit unit project intended to provide students with a forum to investigate a theoretical or applied topic in environment and sustainability. This may include scientific, technical, political, social, economic, cultural, and institutional attributes of environmental and sustainability challenges. Projects are intended to be interdisciplinary in scope, and allow students to further develop critical thinking and research skills as they investigate real-world environmental challenges in areas such as government, industry, and community-based organizations (Kindrachuk, 2010). Already mentioned above, the RBLBRA supported four graduate students over the past ten years working on issues including: exploring the meanings and cultural landscapes of elder residents in Redberry (Everts 2008); community capacity for ecosystem management (Mendis-Millard, 2004); and ecological services provided by farmers and ranchers in the Redberry Lake Biosphere Reserve (Bonnell & Garrigou, 2002). The RLBRA also collaborated with Dr. Maureen Reed's graduate classes from the University of Saskatchewan, identified as Geography 480 from 2003.

The Biosphere Sustainability Group at the University of Waterloo has a number of graduate students who have or are carrying out research and using the experiences of the Redberry Lake Biosphere, along with other Biosphere Reserves, to inform broader sustainability practice and application in the Canadian and international context (Biosphere Sustainability Group, 2011).

The RBLBRA is actively developing measurable indicators and targets for land use, recreation, heritage, green space, facilities and environmental stewardship through its regional land use planning initiative (See Section 4.0 for additional information; Prairie Wild, 2010).

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The Redberry Lake Biosphere Reserve Research and Education Centre provides opportunities for environmental/sustainability education.

“With these funds [Provincial], the committee renovated its original interpretive center [2002] to become a research and education center, placing greater emphasis on their displays on the cultural and biological diversity in the biosphere reserve and on providing logistical resources for research. They also obtained specific funding for local stewardship projects, bringing local farmers on board with the biosphere reserve objectives. Linkages with the public school were strengthened, a youth member was added to the board, and environmental projects with the school were given international recognition... The hiring of a new coordinator in the summer of 2006 was viewed as a means to maintain the renewed momentum as she was charged with maintaining the center, continuing to obtain funding for new projects, and encouraging broad based participation in the region.” (Mendis-Millard and Reed, 2007).

The period from 2006-2010 was productive for the Centre providing interpretive services. However, as already indicated, funding from the Province ended, which reduced the operation of the Centre. Furthermore, funding is no longer available for the coordinator position.

The RBLBRA is also affiliated with the ASPnet School in Hafford, Saskatchewan. The Biosphere Reserve was the first to include an ASPnet School and it was the first ASPnet School in Saskatchewan. ASPnet stands for UNESCO's Associated Schools Project Network and is a global network of more than 8.500 educational institutions in 180 countries. The biosphere supported “construction of an outdoor classroom that students and teachers alike enjoy using. The students also enjoy our [Biosphere] annual water monitoring field day on Oscar Creek, where we show them the how-to on water monitoring and a macro-invertebrate study that is always a hit for all ages” (Kinderchuk, 2010). Furthermore, as of 2010, Diane Hawrysh, one of the RBLBRA Directors, became Chair of the ‘Building Linkages between BRs and ASPNet’ ad hoc committee of the Canadian Commission for UNESCO. This demonstrates the manner in which the RBLBRA continues to contribute nationally connecting with not only others in the educational field in biosphere reserves but also in ASPNet schools not in BRs. The Hafford ASPNet School also participated in an international art display project.

“The display demonstrates how youth artwork has both connected students and schools in biosphere reserves around the world while helping them learn about the biodiversity of each others’ regions.

Housed at the Redberry Lake Biosphere Reserve, this display has already been circulated among and added to by youth in three of our Canadian biosphere reserves – Redberry Lake, Riding Mountain and the Bruce Peninsula in the Niagara Escarpment – as well as in ASPNet schools from Lithuania and Western Australia” (Hawrysh et al. 2010, p. 2).

7.0 GOVERNANCE AND “CIVIL SOCIETY” CONTEXT FOR THE BIOSPHERE RESERVE

What is the overall framework for governance in the area of the biosphere reserve? Identify the main components and their contributions to the biosphere reserve

The RBLBRA is governed by a board composed of nine members including farmers, (the Executive Director is also a farmer), municipal representatives, one educator affiliated with the ASPnet School in Hafford who is also the Chair of the Building Linkages ad hoc committee of the Canadian Commission for UNESCO (see section above), and a cultural expert . The representation on the Board allows the RBLBRA to play a pivotal role at the local level, bringing representation from the farming community and providing direct links to local decision-making. In the uneven environmental management environments that are prevalent in Canada as described by Reed (2007), the RBLBRA successfully established a workable governance structure that allows volunteers to work together on sustainability initiatives and to demonstrate viable alternatives to broader trends, in particular, the move to industrial agriculture. The RLBRA is an excellent example of a local civil society group successfully influencing a range of activities from agriculture to land use planning.

The other key strategy employed by the RLBRA is their ability to work with and leverage their sustainability activities by delivering complimentary programs run by other organizations such as the Prairie Conservation Action Plan (no date) and Watershed Awareness Initiative (no date).

8.0 CONCLUSIONS AND RECOMMENDATIONS

The reviewers conclude that the Redberry Lake Biosphere Reserve is functioning as intended by UNESCO. The Biosphere is demonstrating sustainability primarily by working on alternative approaches to agriculture. Industrial agriculture is transforming Canadian farming, forcing many farmers to either change practices to ones that are less sustainable or to get out of the business. In the Redberry Biosphere, farmers are demonstrating an alternative form of agriculture based on the use of prairie grass for cattle production, which is economically viable, and culturally and socially sustainable, and environmentally responsible ensuring ecosystem services continue to flow from the land. This fits with the sustainable livelihoods/development

and logistics functions of biosphere reserves to promote demonstrate and encourage research, education and training pertaining to alternative and more sustainable methods of production.

The RBLBRA is also engaging in leading edge voluntary regional land use planning involving mapping of current conditions, desirable future conditions and linking the results to decision-making processes that many Board members are involved with. The Biosphere is also engaged in important work on the climate change and adaption front. There is broad agreement that climate change is having impacts on the Prairies, in particular more severe rainfall events. In response, the Biosphere Board has engaged in a project to develop and implement a proactive standardized cost/benefit analysis model to assist decision-makers in dealing with flooding impacts on agriculture and rural infrastructure.

Below, the reviewers make a number of recommendations that were discussed with the Biosphere Board and those interviewed for this review. The Biosphere Board should consider the following suggestions:

1. Extending the area of cooperation/transition to include the additional RMs participating in the regional planning initiative. This recommendation would change the BR from a watershed-based boundary to a boundary that contains an entire watershed but is also based on politically/administratively-boundaries as well. The implications of this for funding etc. Should be considered carefully.
2. Continue experimenting with grass-fed cattle production and agricultural stewardship, and work to translate this expertise to the broader community so that the area becomes recognized as a leader and innovator in viable alternative prairie agriculture.
3. Continue to collaborate with partners including the Canadian Wildlife Service and other NGOs such as Duck Unlimited and Delta Waterfowl to design and implement a comprehensive monitoring program for the core area of the Biosphere.
4. Develop a branding program with assistance from the Rhön Biosphere reserve in Germany.

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Appendix 1: Biosphere Reserve Information

General Description

Redberry Lake Biosphere Reserve is situated in the province of Saskatchewan in the south-west of Canada, covering 112,200 hectares. The regional landscape is composed of rolling prairie, dotted with seasonal ponds and marshes, along with aspen/shrub groves. The core area is a saline lake with several islands. There are small patches of natural mixed prairie which is very rare in this highly grazed and cultivated part of the prairies.

Redberry Lake is an important site for the conservation of several significant species of birds. It provides habitat for nine endangered, threatened, or rare bird species, as well as over 180 other species. Monitoring nesting sites of American White Pelican (*Pelecanus erythrorhynchos*) is one of the research and monitoring activities undertaken in the area. Less than 1000 people live in the area (2006) and most of them are Euro-Canadians, primarily of Ukrainian origin. The primary economic activities in the region are agriculture and livestock raising. Eco-tourism development over the past decades has encouraged new ways of looking at local habitats, and brought new hope to some community enterprises. The expansion of sustainable tourism activities in tandem with wildlife protection is supported by a vast majority of stakeholders, including representatives of the local communities. The protected status of the site prevents tourism from intruding into the delicate areas and allows tourist numbers to be kept at sustainable levels.

New sustainable models of agriculture including grazing management in Prairies ecosystems are being adopted and there exists a strong potential to undertake the development of new, sustainable agriculture, livestock, and silviculture products that could be marketed under the 'brand' of the biosphere reserve. There is also a potential for linkages with other biosphere reserves to market the products of sustainable resource use, as well as educating the general public about conservation practices.

Major ecosystem type

Temperate grassland; saline lake

Major habitats & land cover types

Grasslands including typical prairie grasses such as wheat grass (*Agropyron* spp.), fescue (*Festuca* spp.), oat grass (*Avena barbara*), sedges etc.; aspen-shrub forest dominated by aspen (*Populus tremuloides*) with several shrubs such as *Rosa* spp., silver willow (*Salix alba*) and hawthorn (*Crataegus* spp.); saline lake/rocky islands; farmland cultivated with wheat, and barley; pasture land

Location

52°42'N; 107°10'W (centre of core area)

Area (hectares)

<i>Total</i>	112,200
<i>Core area(s)</i>	5,600
<i>Buffer zone(s)</i>	6,300
<i>Transition area(s) when given</i>	100,300
Altitude (metres above sea level)	+487 to +533
Year designated	2000
Administrative authorities	Redberry Regional Economic Development Authority Corporation

Research and monitoring...

Brief description	Water quality monitoring of streams leading to the lake Lake limnology, UVB impact measurement Climate change: UV radiation effects and ice phenology (ice-on / ice-off protocols) Pesticide drift analysis Monitoring nesting sites of American White Pelican (Pelecanus erythrorhynchos) Endangered species monitoring Waterfowl research Recreational and tourist visitor impacts Mapping of the different zones of the biosphere reserve
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Specific variables...

Abiotic	Climate, hydrology, monitoring/methodologies, pollution, pollutants, UV radiation/solar radiation.
Biodiversity	Birds, freshwater/inland water, methodologies, rare/endangered/threatened species.
Socio-economic	Recreation, tourism.
Integrated monitoring	Impact and risk studies/Environmental impact, mapping, planning and zoning measures/zonation.

Contact...

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Appendix 2 List of Projects Undertaken in Redberry Lake Biosphere Reserve

Initiative/Project Name available	Participants	Organization	Date/Duration	Activities/Outcome	Note
Regional Planning	Lenore Swystun	Prairie Wild Consulting	2011	Research: developing indicators and targets for land use, recreation, heritage, green space, facilities, and env-al stewardship	Response to potential future oil and gas exploration and extraction in the region
Saskatchewan Watershed Awareness Initiative (2010)	Gord, Vaadeland - watershed awareness advisor	Provincial Council of Agriculture Boards - non-profit agriculture organization that focuses on agriculture programs	2010		Awareness about the importance of the watershed, and that activities on the farm may impact the watershed and yourself by actions of others within the watershed
Redberry Watershed Agri-Environmental Group Plan (AEGP) and Canada-Saskatchewan Farm Stewardship Program***	6 RMs (4 are part of the BR; 2 are neighbouring); Saskatchewan Watershed Authority; Ducks Unlimited Canada; PFRA; Dave O'Bertos	RLBR Association	AEGP: since 2006? CSFSP: April 2011 - March 2012	Watershed assessment; Community outreach: CSFSP	CSFSP: The program is designed to help Saskatchewan producers address on-farm environmental risk. The idea of the project is to create awareness, and the benefits of reducing the risks of Agri-Environmental issues concerning soil, water, air and biodiversity. The CSFSP provides eligible Saskatchewan producers with financial assistance to implement beneficial management practices (BMP) to help maintain or improve the quality of soil, water, air or biodiversity resources.
Land and Infrastructure Resiliency Assessment Project (LIRA)	John Kindrachuk Cameron Kayter steering committee: SARM, ministry of municipal affairs, ministry of highways, SWA (Sask Watershed Authority), SAW (Sask Association of Watershed) Lenore Swystun	The Agri-Environment Services Branch North West Enterprise Region (NWER)	2010	evaluate climate change on rainfall events	LIRA methodology is used to assess the landscape to determine whether current infrastructure will be able to withstand extreme weather events such as heavy precipitation. LIRA is a tool that can help communities mitigate potential damages associated with such events. LIRA is a five phase process that is being used to transition the methodology from research to operational status. It is anticipated that Phase 4 will start in Jan.2011, subject to availability of resources.
Saskatchewan Wildlife Federation's Habitat Trust Lands program					* Lands provide habitat for wildlife and access to local residents and visitors for recreation *Grazing in order to increase biodiversity
Provision of a dense cover for waterfowl in the watershed		Ducks Unlimited		Habitat management	
Water level studies		<input type="checkbox"/> Saskatchewan Watershed Authority <input type="checkbox"/> SaskWater <input type="checkbox"/> The Redberry Pelican Project	since 1965	Monitoring	Water level have been changing all the time, since 2004 has been rising

The chemistry of Redberry Lake's water	Joe Schmutz	U of S		Research	Surface runoff and below ground aquifers
Studies of white-winged scoters***	Alisaukas, Ray (Environment Canada and UofS) Kehoe, Pat(Duck Unlimited) Traylor, Joshua (U of S) Kellett, Dana (Environment Canada) Swoboda, Cindy (Environment Canada) Kindrachuk, John (RLBR)(discussed challenges)	Ducks Unlimited Environment Canada U of S RLBR	since 2000	<input type="checkbox"/> examining nesting ecology <input type="checkbox"/> brood rearing <input type="checkbox"/> heavy metal contamination in the duck's bloodstream <input type="checkbox"/> predator control	<u>Supporting Organizations:</u> Ducks Unlimited Canada Environment Canada Institute for Wetlands and Waterfowl Research Redberry Lake Biosphere Reserve University of Saskatchewan
Bacteria in Redberry Lake	Tumber, V.P. Robarts, Richard D. Arts, Michael T. Evans, Marlene S. Caldwell, Douglas E.		1993	Research	
North American Waterfowl Management Plan IBA	Joe Schmutz <u>Assistance:</u> IBA program participants; Nature Saskatchewan; Bird Studies Canada <u>Funding partners:</u> Wildlife Habitat Canada; Canadian Adaptation and Rural Development Saskatchewan (CARDS); the U of S; Saskatchewan Environment and Resource Management (SERM); the Canadian Millenium Partnership	Nature Saskatchewan RLBR	Dec-99		
Ground water chemical analysis		<input type="checkbox"/> National Water Research Institute <input type="checkbox"/> SaskWater	1988		
Data on the limnology of the lake (papers)		<input type="checkbox"/> Environment Canada <input type="checkbox"/> National Water Research Institute <input type="checkbox"/> U of S	1941-1986		24 published papers
Salinity levels		<input type="checkbox"/> Environment Canada <input type="checkbox"/> National Water Research Institute <input type="checkbox"/> U of S	1926-1986	Monitoring	
Chemical and physical properties of RBL	Bowen and Sachs (2008) Waiser and Roberts (2000)		2008 and 2000	Research	
American White Pelican nest counts and banding		The Canadian Wildlife Service	1951-yearly	Monitoring	
Fish stocking history and results study		Saskatchewan Environment and Resource Management	1971		
Double crested cormorant banding study	Stuart Houston		1971		
Piping plover nest survey	John, Kindrachuk	Saskatchewan Environment and Resource Management RLBR	since 1984 every 5 years		
Joint federal/provincial wildlife survey		<input type="checkbox"/> Saskatchewan Environment and Resource Management <input type="checkbox"/> The Canadian Wildlife Service	1986		

Inventory of birds and wildlife habitats at Redberry		<input type="checkbox"/> Saskatchewan Environment and Resource Management <input type="checkbox"/> The Canadian Wildlife Service	1986		
Nest counts		The Canadian Wildlife Service	1987 - present		
Studies of white-winged scoters		<input type="checkbox"/> The Canadian Wildlife Service <input type="checkbox"/> Ducks Unlimited	1998 started again 1980s		
Ice-on/Ice-off dates		The Redberry Pelican Project Foundation (initial society developed ecotourism)	1947-1998		
Aspen Regional Economic Association monograph			1996		Available through the Redberry Pelican Project Foundation
Community Vision (Cooperation Plan)	Sherry Sian	Inuvialuit Environment & Geotechnical Inc.	2002		Sian S., Redberry Lake Biosphere Reserve, A Community's Plan for Sustainability, 2001.
Introduction to an Inventory of the Ecological Services Provided by Ranchers and Farmers in RLBR	Bonnel and Garrigou	Ecole Nationale du Génie Rural	2002		This large project is one of the medium term strategic actions outlined in the Community's Plan for Sustainability (Sian 2001)
Community Capacity***	Mendis-Millard and Reed Local residents	U of S	2007	Thesis; Paper;	
Environmental Management	Reed	U of S	2007	Paper	
Cultural landscape studies	Everts		2008		
Water quality of streams leading into the lake		The Redberry Pelican Project Foundation	Ongoing	Monitoring	Foundation was prior to the designation
Hydrology testing		National Water Research Institute	Ongoing		
Bathymetry of Redberry Lake		The Redberry Pelican Project Foundation	1999		
Geology/geomorphology of transition and buffer zones		The Redberry Pelican Project Foundation	1999	Collection and organization of data	
Sediment profile and analysis of Redberry Lake		National Water Research Institute	1999		
Research projects for students (6 credit project)	SENS	U of S	2011- present	Field work	
ASPnet (UNESCO's Associated Schools Project Network)	Hafford, Saskatchewan Diane Hawrysh				
Building Linkages between Canadian UNESCO Associated Schools and Canadian Biosphere Reserves	Committee Members: - Diane Hawrysh (committee chair) Redberry Lake Biosphere Reserve, HCS ASPnet - Valerie Pankratz Riding Mountain Biosphere Reserve - Elizabeth Burrows Bruce Peninsula District School ASPnet - Louise Johnstone Bruce Peninsula Biosphere Reserve Association - Nicole O'Bomsawin Abenake Lac St. Pierre Biosphere reserve - Daryl Eschelby Lockport NS ASPnet		7-May-10	Developed an action plan to build better linkages between Canadian ASPnet Schools and Canadian Biosphere Reserves	

Lakeshore Management Study	RM Redberry	BEAK and Associates	1989	producing zoning bylaws for lake management	Information piece and bibliography for the MAB nomination
RLBR: Community Mapping Report	Lenore Swystun Caitlin Nahirney Community members of Blaine Lake, Great Bend, Redberry, Douglas, Meeting Lake and Mayfield along with the Towns and Villages of: Radisson, Bordon, Speers, Hafford, and Blaine Lake North West Enterprise Region (NWER)	Prairie Wild Consulting Co.	2010		Sustainable Community Plan
Eco-Tourism development; Product labelling and quality economies; Landscape conservation and land use conflicts; Agriculture, organic farming and marketing; National and international partnership development;		The Rhön Biosphere Reserve in Germany and two other Canadian Biosphere Reserves; RLBR;			
Source Water Protection		RLBR; North Saskatchewan River Basin Council (NSRBC) SAW	2010	Educating and promoting about the importance of protecting and conserving water within watershed	
Sustainable Development Strategy		Redberry Pelican Project Foundation Sustainable Community Planning program (funding)	1999 and 2000		Draws all the other plans together in an easily-referenced and implemented document
Redberry Pelican Project Foundation		Redberry Pelican Project Foundation	Founded in 1989	Its original aim was to ensure that tourism to the province's Redberry Lake was environmentally acceptable. Conservation of the environment through education, research, and tourism. Provides information on Pelican species in Canada.	Prior to RLBR being nominated
Redberry Lake Biosphere Reserve: A model for community-university partnerships	Mendis, S., Herman, V. and P. Kingsmill	U of S RLBR	May 8-10, 2003	Poster presentation at the Community-University Institute for Social Research (CUISR) CUExpo	
Building social and cultural capital: The Redberry Lake Biosphere Reserve	Mendis, S.	U of S	2003		Funded by the Community University Social Research Institute at the University of Saskatchewan that aims to promote community-based research
G480 Project (UofS)	Maureen Reed	U of S		work on civic science	
Sustainability plan and the stakeholder engagement process	Peter Kingsmill and Sian	Leading Edge Conference	2002 or 2003	Presentation	