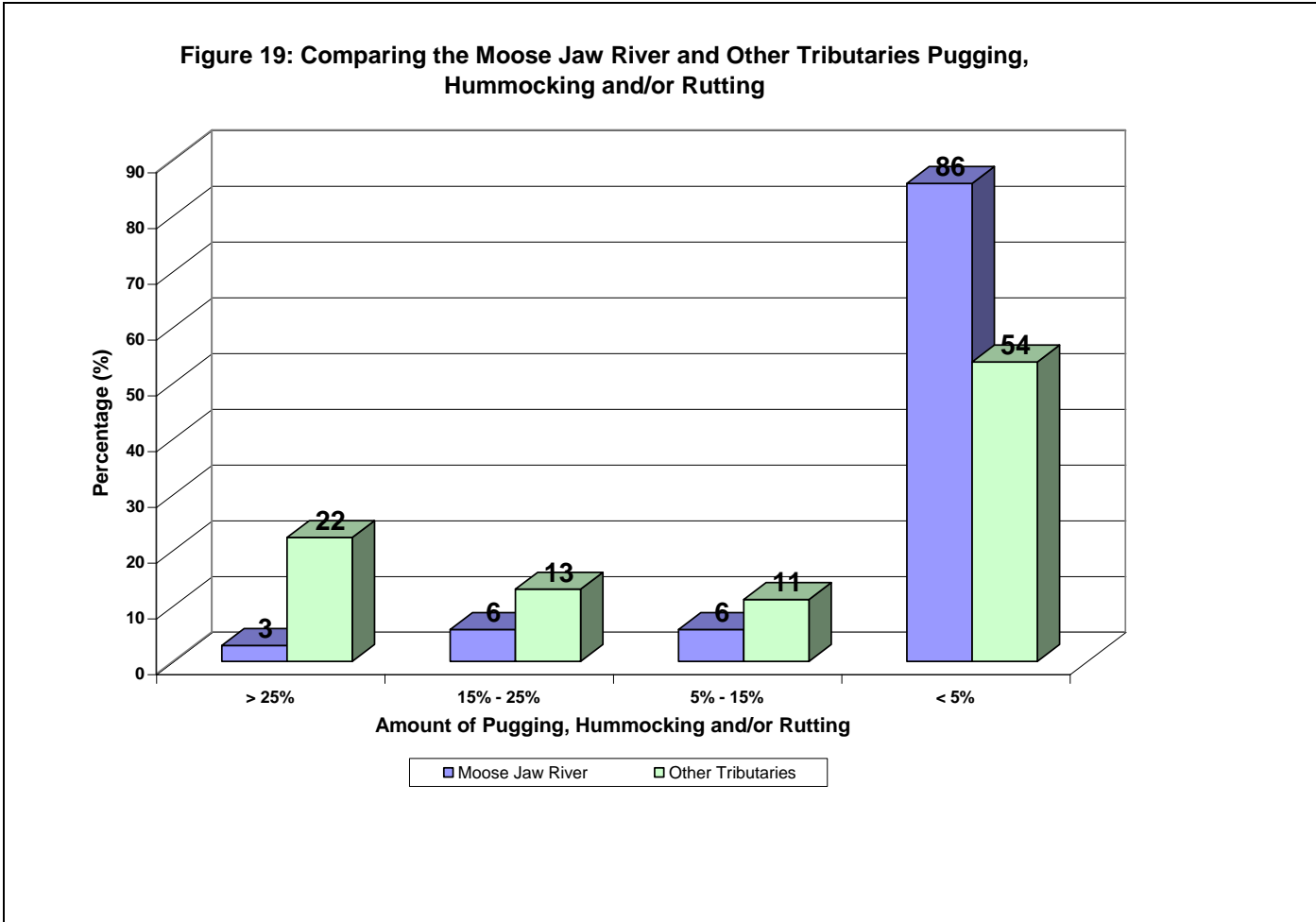


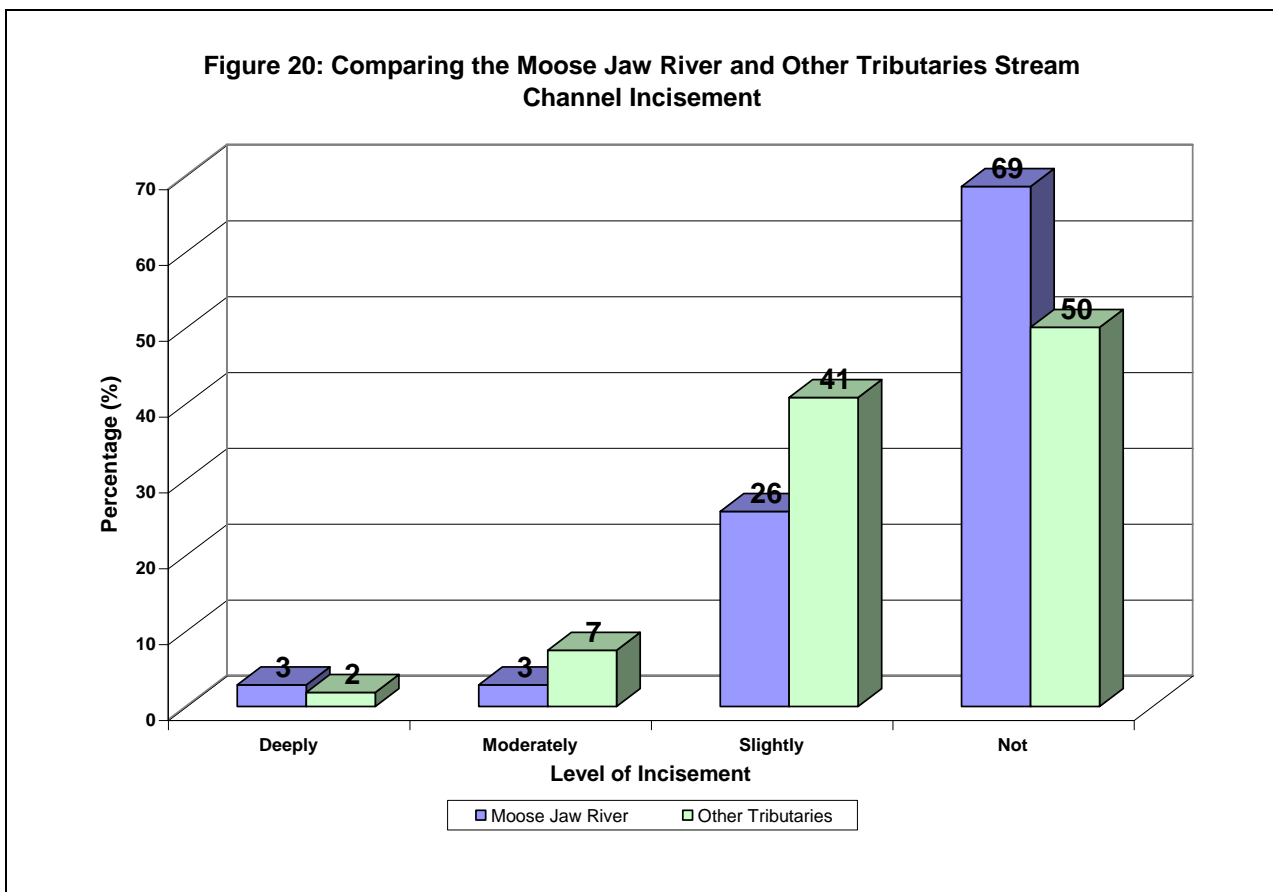
5.2.2.4 Pugging, Hummocking and Rutting

The definitions of pugging, hummocking and rutting can be found in Adams, B.W et al., 2001 page 58. The purpose is to evaluate the amount of soil compaction from livestock and vehicle use in the riparian area. This component determines the percentage of the reach that is affected by pugging, hummocking and/or rutting. See Figure 19 for the results from the study.



5.2.2.5 Stream Channel Incisement (Vertical Stability)

Stream channel incisement refers to the vertical steepness of the banks. Incisement or down cutting, can limit the ability of the stream to access its floodplain (definition for floodplain can be found in Adams, B.W et al., 2001 page 59) during high water events such as flooding. Incisement can result from such activities as cumulative effects of vegetation removal, drainage and roading which affect runoff, water additions, or installations occurring upstream of the reach. This component is evaluated on the incisement stage at the time of the evaluation. Incisement stages are outlined in detail on pages 61 to 67 of Adams, B.W et al., 2001. See Figure 20 for results.



6. Discussion

6.1 Health Categories

The data was broken down and evaluated for the Moose Jaw River and Other Tributaries. The purpose of the break down was to assess the effect that the tributaries had on the largest channel, the Moose Jaw River. The evaluation was further broken down and each assessment values were averaged for the vegetation and soil/hydrology sections.

Example:

Question	1	2a	2b	3	4	5	6	7	8	9	10	11	Total
Out of	6	3	3	3	6	3	3	6	6	6	3	9	57
Score	6	2	1	1	0	0	0	6	6	6	0	9	37

Vegetation % = $10/27 * 100\% = 37\%$

Soil/Hydrology % = $27/30 * 100\% = 90\%$

Overall Health Rating: 65% **Health with Problems**

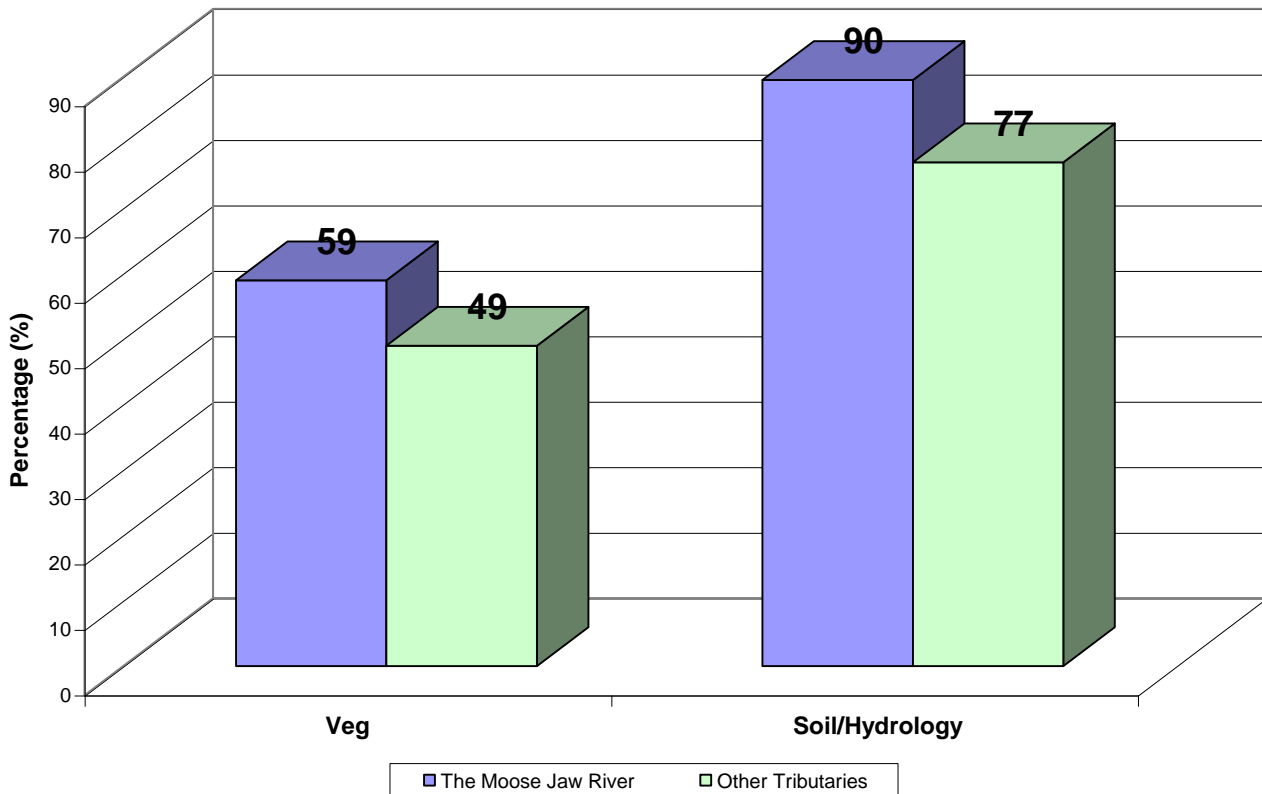
The results showed that the vegetation section was significantly worse than the soil/hydrology section (see figures 8-14 and figures 16-20). It is determined from the results that both the Moose Jaw River and Other Tributaries scored an unhealthy average, \leq (less than or equal to) 59% for the vegetation sections, see Figure 21. A complete list (of scientific and common names) of the vegetation species for streambank and floodplain areas are found in Appendix 5, the species that are highlighted indicate a duplicate species found both on the streambank and in the floodplain.

The largest down falls for the vegetation section was the weed density, disturbance vegetation and lack of preferred woody vegetation, see figures 10-12. Although the Moose Jaw River scored higher than the Other Tributaries it is still a significant issue for the whole sub-watershed.

The soil/hydrology section scored significantly higher for both the Moose Jaw River and the Other Tributaries than the vegetation section. The Moose Jaw River had the highest average for the soil/hydrology section, scoring healthy or proper functioning condition $\geq 80\%$. The Other Tributaries scored a healthy with problems or functional at risk 60-79% rating. It is recognized that the Other Tributaries healthy with problems rating will eventually affect the Moose Jaw River.

Where this section lost the most points was in the amount of pugging, hummocking and/or rutting, see Figure 19. This could infer that livestock are grazing the sensitive riparian area too early in the season creating more damage than is necessary.

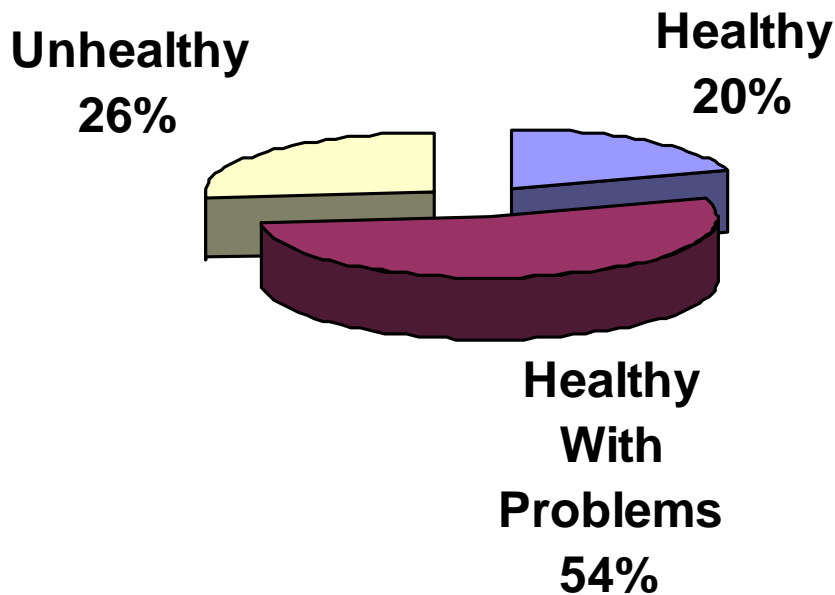
Figure 21: Comparing the Moose Jaw River and Other Tributaries Vegetation and Soil/Hydrology Health Category Averages



6.2 Overall Health Ratings

The average health rating for the Moose Jaw River Sub-Watershed is healthy with problems or functional at risk, see Figure 22. This rating indicates that the sub-watershed has some issues that need attention. The largest problem impairing the health is the vegetation components with noxious weeds on a large dispersal rate, undesirable disturbance vegetation overtaking the preferred species, the lack of preferred shrubs and the overall impact land-use practices are having on the tributaries. To view health ratings for each riparian health assessment see Figure 2.

Figure 22: Health Ratings For Riparian Areas of the Moose Jaw River Watershed



7. Mitigation Strategy

The Moose Jaw River Watershed Stewards Inc. (MJRWS) has started to mitigate some of the issues surrounding riparian health in the Moose Jaw Watershed. In the spring of 2006 the group has implement an Agri-Environmental Group Plan. Residents within the watershed benefit from three beneficial management practices (BMPs); wintering site management, riparian area management, and erosion control structures (riparian).

A contact list of all the individuals participating in the riparian health study was compiled. Some landowners have already been contacted, and projects are already in the works. The rest of the landowners will be contacted later in the winter to start mitigation projects.

Landowners with healthy riparian ratings will be contacted in the future, and be featured in one of the MJRWS's quarterly newsletter as "good stewards". Their land management and environmental sound practices will be promoted in producer profile articles that other landowners will be able relate to.

8. References

Adams, B.W., Fitch, L., and Hale, G., 2001 Riparian Health Assessment for Streams and Small Rivers – Field Workbook. Lethbridge, Alberta: Cows and Fish Program

Agriculture and Agri-Food Canada, 2007 Guide to the Canada-Saskatchewan Farm Stewardship Program (CSFSP)

Saskatchewan Watershed Authority, 2005 Preliminary Background Report Moose Jaw River Watershed

Saskatchewan Watershed Authority, 2006 Riparian Health Assessment Report for the Upper Qu-Appelle Conveyance Improvement Project

Appendix 1

Riparian Health Assessment – Streams and Small Rivers

Landowner: _____ Date: _____

Stream or River: _____

Legal Land Location: _____

GPS Start Pt: _____ GPS End Pt: _____

Land Use Practices: **Healthy or Healthy w/ Problems or Unhealthy (estimate)**

Grazed or Hayed or Idled

Native or Tame

Cropped-Stubble or Cropped no stubble or No crop No stubble or No Crop-Stubble

Stream Type: **Perennial or Ephemeral or Intermittent**

Stream Order: _____

Flood Plain Vegetation: _____

Stream _____ Bank _____ Vegetation: _____

1. How much of the riparian area is covered by vegetation?

2. How much of the riparian area is covered by weeds?

Density/ Distribution?

3. How much of the riparian area is covered by disturbance-caused vegetation?

4. Is woody vegetation present and maintaining itself?

5. Is woody vegetation being used?

6. How much dead wood is there?

7. Are the streambanks held together with deep-rooted vegetation?

8. How much of the riparian area has bare ground caused by humans?

9. Have the streambanks been altered by human activity?

10. Is the reach lumpy and bumpy from use? (pugging, hummocking and rutting)

11. Can the stream access its floodplain? (stream channel incisement)

Summary:

Question	1	2a	2b	3	4	5	6	7	8	9	10	11	Total
Out of	6	3	3	3	6	3	3	6	6	6	3	9	57
Score													

Appendix 2

Riparian Assessment Comments

Safety Concerns:

- Due to the working conditions: extreme heat, rain, working around moving water, and remote areas, there should be at least two people working together at all times
- A strong communication plan with land locations and approximate times should be detailed and left at a base location before each day of field work
- A phoning system should be implemented, for example: technicians should call the base station at 9:30 everyday and when they are on the road homebound to give an approximate time for their arrival.
- A cell phone is an absolute must!

Vehicle Considerations:

- Money should be allocated in the budget for a truck rental for field season, approx 3-4 months
 - These types of assessments require a truck to get into remote locations and rural roads

Work Plan:

- Work plan should be developed and approved by superiors before any action is taken
- Site selection/ study implementation plan should be done in the winter months prior to the study
- Allowing for a longer field season will result in a larger sample size and allow for weather days and much needed office days to organize data and pictures
- Landowner contact information should be gathered far in advance of field work days
- Landowners should be contacted in the evening a day or two before technician wants access to their land so they are less likely to forget your arrival
- Technicians should be familiar with the area before venturing out to remote areas
- Local forecasts should always be consulted before field days

Appendix 3

Noxious Weed Species List For the Moose Jaw River Watershed

-Bull Thistle	- <i>Cirsium vulgare</i>
-Canada Thistle	- <i>Cirsium arvense</i>
-Leafy Spurge	- <i>Euphorbia esula</i>
-Nodding Thistle	- <i>Carduus nutans</i>
-Purple Loosestrife	- <i>Lythrum salicaria</i>
-Scentless Camomile	- <i>Matricaria perforate</i>

Appendix 4

Disturbance Vegetation Species List For the Moose Jaw River Watershed

-Broomweed	- <i>Gutierrezia sarothrae</i>
-Common Hoarse Tail	- <i>Equisetum arvense</i>
-Common Plantain	- <i>Plantago major</i>
-Common Tansey	- <i>Tanacetum vulgare</i>
-Crested Wheatgrass	- <i>Agropyron cristatum</i>
-Dandelion	- <i>Taraxacum officinale</i>
-Field Bindweed	- <i>Convolvulus arvensis</i>
-Foxtail Barley	- <i>Hordeum jubatum</i>
-Flixweed	- <i>Descurainia sophia</i>
-Goats Beard	- <i>Tragopogon dubius</i>
-Gumweed	- <i>Grindelia squarrosa</i>
-Kentucky Bluegrass	- <i>Poa pratensis</i>
-Narrow-leaved Hawk's-beard	- <i>Crepis tectorum</i>
-Perennial Sow Thistle	- <i>Sonchus arvensis</i>
-Prickly Lettuce	- <i>Lactuca scariola</i>
-Quack Grass	- <i>Elytrigid repens</i>
-Russian Thistle	- <i>Salsola pestifer</i>
-Smooth Brome	- <i>Bromus inermis</i>
-Stinging Nettle	- <i>Urtica dioica</i>
-Stinkweed	- <i>Thlaspi arvense</i>
-Western Dock	- <i>Rumex occidentalis</i>
-Wild Licorice	- <i>Glycyrrhiza lepidota</i>

Appendix 5

Stream Bank Species List For the Moose Jaw River Sub-Watershed

<u>Common Name</u>	<u>Scientific Name</u>
-Alfalfa	- <i>Medicago sativa</i>
-American Milk Vetch	- <i>Astragalus frigidus</i>
-Brown Eyed Susan	- <i>Gaillardia aristata</i>
-Bulrush	- <i>Scirpus spp.</i>
-Canada Golden Rod	- <i>Solidago canadensis</i>
-Choke Cherry	- <i>Prunus virginiana</i>
-Common Cattail	- <i>Typha latifolia</i>
-Common Pepper-grass	- <i>Lepidium densiflorum</i>
-Common Plantain	- <i>Plantago major</i>
-Foxtail Barley	- <i>Hordeum jubatum</i>
-Green Needle Grass	- <i>Stipa viridula</i>
-Kentucky Bluegrass	- <i>Poa pratensis</i>
-Leafy Spurge	- <i>Euphorbia esula</i>
-Low Sedge	- <i>Carex eleocharis</i>
-Manitoba Maple	- <i>Acer negundo</i>
-Pasture Sage	- <i>Artemisia frigida</i>
-Prairie Cone Flower	- <i>Ratibida columnifera</i>
-Prickly Rose	- <i>Rosa acicularis</i>
-Quack Grass	- <i>Elytrigia repens</i>
-Red Osier Dogwood	- <i>Cornus stolonifera</i>
-Reed Canary Grass	- <i>Phalaris arundinacea</i>
-Rush	- <i>Juncus spp.</i>
-Salt Grass	- <i>Distichlis stricta</i>
-Smooth Brome	- <i>Bromus inermis</i>
-Snowberry	- <i>Symphoricarpos occidentalis</i>

- Sunflower
- Tall Manna Grass
- Thread Leaved Sedge
- Tufted Hair Grass
- Water Parsnip
- Water Smart Weed
- Western Dock
- Western Wheatgrass
- Wild licorice
- Wild Mint
- Willow

- Helianthus annuus*
- Glyceria grandis*
- Carex filifolia*
- Deschampsia caespitose*
- Sium Suave*
- Polygonum amphibium*
- Rumex occidentalis*
- Agropyron smithii*
- Glycyrrhiza lepidota*
- Mentha arvensis*
- Salix spp.*

Flood Plain Species List
For the Moose Jaw River Watershed

-Alfalfa	- <i>Medicago sativa</i>
-American Milk Vetch	- <i>Astragalus frigidus</i>
-Awned Wheatgrass	- <i>Agropyron subsecundum</i>
-Balsam Poplar	- <i>Populus balsamifera</i>
-Broomweed	- <i>Gutierrezia sarothrae</i>
-Canada Golden Rod	- <i>Solidago Canadensis</i>
-Canada Thistle	- <i>Cirsium arvense</i>
-Choke Cherry	- <i>Prunus virginiana</i>
-Common Caragana	- <i>Caragana arborescens</i>
-Common Plantain	- <i>Plantago major</i>
-Crested Wheatgrass	- <i>Agropyron cristatum</i>
-Foxtail Barley	- <i>Hordeum jubatum</i>
-Goat's-beard	- <i>Tragopogon dubius</i>
-Green Needle Grass	- <i>Stipa viridula</i>
-Gumweed	- <i>Grindelia squarrosa</i>
-Kentucky Bluegrass	- <i>Poa pratensis</i>
-Leafy Spurge	- <i>Euphorbia esula</i>
-Low Sedge	- <i>Carex eleocharis</i>
-Manitoba Maple	- <i>Acer negundo</i>
-Narrow-leaved Hawk's-beard	- <i>Crepis tectorum</i>
-Pasture Sage	- <i>Artemisia frigida</i>
-Prairie Cone Flower	- <i>Ratibida columnifera</i>
-Prairie Sage	- <i>Artemisia ludoviciana</i>
-Prickly Rose	- <i>Rosa ocicularis</i>
-Quack Grass	- <i>Elytrigia repens</i>
-Red Osier Dogwood	- <i>Cornus stolonifera</i>
-Reed Canary Grass	- <i>Phalaris arundinacea</i>
-Round Leaf Hawthorn	- <i>Crataegus rotundifolia</i>
-Salt Grass	- <i>Distichlis stricta</i>

- Saskatoon Berry
- Smooth Brome
- Snowberry
- Stinkweed
- Sunflower
- Thorny Buffalo Berry
- Tufted Hair Grass
- Water Smart Weed
- Western Dock
- Western Wheatgrass
- White Sweet Clover
- Wild Gooseberry
- Wild licorice
- Wild Mint
- Willow
- Yellow Sweet Clover
- Amelanchier alnifolia*
- Bromus inermis*
- Symphoricarpos occidentalis*
- Thlaspi arvense*
- Helianthus annuus*
- Shepherdia argentea*
- Deschampsia caespitose*
- Polygonum amphibium*
- Rumex occidentalis*
- Agropyron smithii*
- Melilotus alba*
- Ribes oxycanthoides*
- Glycyrrhiza lepidota*
- Mentha arvensis*
- Salix spp.*
- Melilotus officinalis*