

Photo Supplement to

Carex Establishment on Reclaimed Oil

Sands Landscapes (North Eastern Alberta)

A case study at Suncor Energy Inc.

Part II-Carex media to Carex vulpinoidea

Purpose and Limitations

Note: The purpose of this work is to supplement my master thesis *Carex Establishment on reclaimed oil sands Landscapes: A case study at Suncor Energy Inc.* with a photographic record of the *Carex* species encountered as part of this research.

Species and habitat descriptions listed in this supplement refer to characteristics applicable to the oil sands region of north eastern Alberta and may not be applicable to areas outside this region. Refer to Appendix G of the thesis for specific information on habitat and *Carex* use in restoration/reclamation. For detailed description of each species and for comparison to species noted as having similar morphologic characteristics, consult one of the excellent identification keys found in *Carex of Saskatchewan* (Hudson, 1977), *Field guide to sedges of the Rocky Mountain Region* (Johnson, 2001), *Flora of Alberta* (Packer, 2000) *Flora of the Canadian Prairie Provinces* (Looman & Best, 1979) or *Flora of North America* (Ball, Reznicek, & Murray, 2002).

ACIMS rankings refer to the subnational rare plant rankings published by Alberta Conservation Information Management System (Kemper, 2009; ANHIC, 2010). A rank of S1 is very rare, while a rank of S5 is common.

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Carex media (Norway sedge)



Moisture:	Moist
Habitat:	Forest openings, shorelines and cutlines
Distinguishing features:	Perigynia with dark chestnut brown, almost black scales, usually three spikes in a tight head-like inflorescence. Perigynia are light green turning brown in late summer.
Similar Species:	None
Synonyms:	<i>Carex norvegica</i>
ACIMS ranking:	S5

PMC Jun-21-2004 #008, PMC Jun-07-2005#76, PMC Jun-21-2006#211, PMC Jun-24-2008/479, SRL June 19, 2009 #6291, 6306, SRL Jul-21-2009, 6572

Carex microptera (small wing sedge)



Moisture:	Moist to dry
Habitat	Open meadows
Distinguishing features:	Inflorescence head-like; perigynia green or straw coloured, contrasting with the dark pistillate scales. Only the lower portion of the perigynia is veined.
Similar Species:	Similar to <i>Carex pachystachya</i> and often difficult to separate the two species.
Synonyms:	None
ACIMS ranking:	S4

PMC Jul-03-2004#006

Carex obtusata (blunt sedge)



Moisture:	Dry
Habitat	Steep, south facing slopes along the Athabasca River and tributaries, often at crest where slopes are too dry for all but a few hardy shrubs.
Distinguishing features:	Inflorescence a single-spike, lower stems and rhizomes distinctly scaly, single androgynous spike. Mature perigynia ascending, dark shiny, immature perigynia appear light coloured with red beak.
Similar Species:	<i>Carex gynocrates</i> , but <i>C. gynocrates</i> is found in wet peat soils on level ground.
Synonyms:	<i>Carex dioica</i>
ACIMS ranking:	S4

PMC Aug-04-2007#364, PMC May-04-2008#391, PMC Apr-25-2009#493, SRL July-20-2009#9681

Carex oligosperma (few-seeded sedge)



Moisture:	Wet
Habitat	Open, shrubby poor fens or bogs, usually on top or side of hummocks
Distinguishing features:	Typically 2-3 spikes containing a few perigynia, subtended by very long bracts, perigynia inflated, leaves inrolled and wiry.
Similar Species:	None
Synonyms:	None
ACIMS ranking:	S3? [Note: ACIMS ranking includes the question mark] Rare

PMC Jul-31-2005#136, PMC Sep-12-2005#146

Carex pachystachya (chamisso sedge)



Moisture:	Wet to moist
Habitat	Open wet meadows in the Boreal Highlands subregion
Distinguishing features:	Small heads, of tightly packed perigynia. Perigynia gold to brown.
Similar Species:	Similar to <i>Carex microptera</i> and often difficult to separate the two species.
Synonyms:	<i>None</i>
ACIMS ranking:	S3

PMC Jul-01-2007#343, PMC Aug-28-2008#429

Carex parryana (Parry's sedge)



Moisture:	Dry
Habitat	Moist meadows and disturbances
Distinguishing features:	Pistillate scales are purple brown and white edged. Inflorescence usually exceeds the leaves. Terminal spike(s) mostly staminate with a few female flowers at tip.
Similar Species:	None
Synonyms:	None
ACIMS ranking:	S3 Watch list
Note:	Johnston (2001) noted that plants are occasionally dioecious (i.e., male and female flowers found on separate plants). This unusual feature has been observed in the oil sands region.

PMC Jun-19-2004#0041

Carex pauciflora (few-flowered sedge)



Moisture:	Wet to moist
Habitat	Open acidic bogs & poor fens, found on the top of sphagnum hummocks.
Distinguishing features:	Perigynia 6-7 mm long, cylindrical, tapered to a long point, plants short < 30 cm.
Similar Species:	<i>Carex microglochin</i>
Synonyms:	None
ACIMS ranking:	S3

PMC Jul-01-2007#341, PMC Jul-01-2008#431

Carex paupercula (bog sedge)



Moisture:	Wet
Habitat	Associated with peat soils
Distinguishing features:	Terminal spike can be staminate (blue arrow) or gynaeandrous (red arrow). Pistillate scales longer & narrower than perigynia, dark brown, orange hairs on roots (black arrow) giving the roots an orange felt-like appearance. Pistillate scales deciduous (fall off) by late summer.
Similar Species:	<i>Carex limosa</i>
Synonyms:	<i>Carex magellanica</i>
ACIMS ranking:	S4

PMC Jun-15-2006#193, PMC July01-2007#344, SRL Jul 24, 2009#7979

Carex peckii (Peck's sedge)



Moisture:	Mesic
Habitat	Associated with mineral soils in forest openings
Distinguishing features:	Pistillate scales white edged, perigynia hairy >3.1 mm, no basal spikes, stems taller than leaves. Male spike > 5 mm.
Similar Species:	<i>Carex rossii</i> and <i>Carex deflexa</i>
Synonyms:	<i>Carex nigromarginata</i> var. <i>elliptica</i>
ACIMS ranking:	S4

PMC May 19-2008#398, PMCMay-31-2008#403, PMC Jun-21-2008#415, PMCApr-11-2009#490, PMC May-16-2009#527

Carex pellita (woolly sedge)



Moisture:	Moist to wet
Habitat	Sand and limestone gravel shorelines along the Athabasca River.
Distinguishing features:	Perigynia pubescent, about 3 mm in length; leaf blades up to 5 mm in width, flat to v-shaped in cross-section, distinctly keeled.
Similar Species:	<i>Carex lasiocarpa</i> and <i>Carex houghtoniana</i>
Synonyms:	<i>Carex lanuginosa</i>
ACIMS ranking:	S5

PMCAug-16-2008#459, PMC Setp-06-2009/536

Carex prairea (prairie sedge)



Moisture:	Moist to wet
Habitat	fens
Distinguishing features:	Ventral leaf sheath is coloured red to copper, and prolonged above the leaf collar (blue bracket).
Similar Species:	<i>Carex diandra</i>
Synonyms:	None
ACIMS ranking:	S3

PMC Jun-16-2006#188, PMC July 03, 2006#216, SRL July-20-2009 #5838

Carex praticola (meadow sedge)



Moisture:	Dry to moist
Habitat	Moist meadows, cutlines and forest openings; associated with mineral soil.
Distinguishing features:	Perigynia 3.7-6.0 mm in length, pistillate scales same width & length as perigynia. Perigynia beak round in cross section.
Similar Species:	<i>Carex aenea</i>
Synonyms:	None
ACIMS ranking:	S5

PMC Jun-21-2007#356, SRL Jul 23, 2009 #7713

Carex pseudocyperus (cypress-like sedge)



Moisture:	Wet to flooded
Habitat	Stream banks and decomposed floating logs
Distinguishing features:	Dropping spikes on long peduncles, many sharp tipped perigynia.
Similar Species:	<i>Carex hystricina</i> but this species has not been reported in the oil sands area.
Synonyms:	None
ACIMS ranking:	S3

PMC Aug-16-2005#135, PMC July 08, 2006#237, PMC Jul-09-2006#240

Carex raymondii (Raymond's sedge)



Moisture:	Mesic to moist
Habitat	Openings in mixed wood forests
Distinguishing features:	A tall sedge up to 70 cm. Numerous leaves per stem, spikes dark and drooping, lowest spike peduncled,
Similar Species:	<i>Carex podocarpa</i>
Synonyms:	<i>Carex atratifomis</i>
ACIMS ranking:	S4
Note:	A stubby variety of this species (next page) was incorrectly recorded as <i>Carex atosquama</i> . Dr. Peter Ball identified this shorter variety < 20 cm tall, with basal spikes, as <i>Carex raymondii</i> . All references to <i>Carex atosquama</i> in the thesis should be combined with <i>Carex raymondii</i> .

Photo: SRL July 16, 2010#8727, SRL July 22-200 #7015 (base photo), SRL July 22-2009#7225 (lower right), PMC Jul -11-2008#436

Carex raymondii -stubby variety



SRL Jul-06-2009#C-08-2849, 2850, 3091; SRL Jul-06-2009#C-083-3235, 3238, 3252, 3291, 3293, 3295, 9947, 9967

Carex retrorsa (turned sedge)



Moisture:	Moist to wet
Habitat	Stream banks & shorelines, associated with flowing water or nutrient rich habitats
Distinguishing features:	Perigynia inflated, lower perigynia <u>reflexed</u> (bent backwards)
Similar Species:	None
Synonyms:	None
ACIMS ranking:	S3

PMC Jul-10-2006#238, PMC, Jun-29-2007#334, PMC Aug-28-2009#535

Carex richardsonii (Richardson's sedge)



Moisture:	Dry to mesic
Habitat	Limestone cobble, sand, associated with jack pine
Distinguishing features:	Conspicuous red, long sheathing bracts (red bracket), perigynia hairy
Similar Species:	None
Synonyms:	None
ACIMS ranking:	S3

PMC Jun-19-2004#014, PMC May-20-2007#294, PMC May-27-2007#302, PMC Jun-09-2007#321

Carex rossii (Ross' sedge)



Moisture:	Dry to mesic
Habitat	Exposed tarsand bluffs, escarpments along major rivers, dry areas with low vegetation cover.
Distinguishing features:	Hairy perigynia >3.1 mm long, <u>basal spikes</u> present. Pistillate scales shorter than perigynia beak. Staminate spike stalked.
Similar Species:	<i>Carex peckii</i> and <i>Carex deflexa</i>
Synonyms:	None
ACIMS ranking:	S4

NCC Jun-24-2007#6110, PMC Jun 24, 2007#330PMC May 19, 2008 #399, PMC May 18, 2008 #389, PMC June 29, 2007 #316

Carex rostrata (beaked sedge)



Moisture:	Wet
Habitat	A species of floating fens, floating mats and patterned fens, often associated with pitcher plants (<i>Sarracenia purpurea</i>).
Distinguishing features:	<i>Carex rostrata</i> has narrow inrolled leaves, strongly glaucous (blue-green waxy coating). Leaf blades are papillose on the upper leaf surface.
Similar Species:	<i>Carex utriculata</i> has wider yellow green leaves and stomata on the lower leaf surface.
Synonyms:	None
ACIMS ranking:	S3
Note:	Flora of Alberta incorrectly assigns the description of <i>Carex utriculata</i> to the name <i>Carex rostrata</i> . Refer to <i>Carex of Saskatchewan</i> and <i>Flora of North America</i> to differentiate between the two species.

PMC July 20, 2006#253

Carex sartwellii (Sartwell's sedge)



Moisture:	Wet
Habitat	marshes
Distinguishing features:	Lower portion of plant dark almost black, distinct nodes on stem. Some middle spikes can be staminate (blue arrows). Ventral leaf sheaths are not translucent, but often appear striate (with parallel lines-red arrow).
Similar Species:	<i>Carex praegracilis</i>
Synonyms:	None
ACIMS ranking:	S4

PMC Jul 15, 2006 #242, PMC Jun 24, 2007 #327

Carex scirpoidea (single-spike sedge)



Moisture:	Wet
Habitat	Marsh, shorelines and creeks banks
Distinguishing features:	One single spike approximately 2 cm long, perigynia with very long hairs. Ventral leaf sheath pubescent. Dioecious (males and female flowers on separate plants).
Similar Species:	None
Synonyms:	None
ACIMS ranking:	S5

PMC Jun-21-2006#209, PMC Aug-23-2007 #368, PMC Jun-23-2008 #421

Carex siccata (hay sedge)



Moisture:	Dry
Habitat	Sandy or loose mineral soil, open areas and disturbances
Distinguishing features:	Perigynia with parallel nerves, terminal spike either androgynous or pistillate. Inflorescence variable, male flowers can appear anywhere, often giving the inflorescence a scruffy look. Inflorescence can appear club shaped when staminate spikes are at the base.
Similar Species:	None
Synonyms:	The name <i>Carex foenea</i> has been erroneously used for <i>Carex siccata</i> in the past.
ACIMS ranking:	S5

PMC Apr-04-2009#484, SRL Jul 29-2009#8673, SRL Jul 29-2009#8719, PMC May-13-2010#1815

Carex sprengelii (Sprengel's sedge)



Moisture:	Mesic
Habitat	Open deciduous forest
Distinguishing features:	Spikes peduncled, perigynia with a very long tube-like beak, often as long as perigynia body (blue bracket).
Similar Species:	None
Synonyms:	None
ACIMS ranking:	S4

PMC May 29-2005#69

Carex stipata (awl-fruit sedge)



Moisture:	wet
Habitat	Beaver dams, marsh edges and ditches along roads, associated with mineral soils.
Distinguishing features:	Perigynia awl shaped 4-5 mm long, with spongy tissue distending the base (blue bract). Long filiform bracts (red arrow). Ventral leaf sheath rugose (wrinkled). Stem distinctly ridged.
Similar Species:	<i>Carex vulpinoidea</i>
Synonyms:	None
ACIMS ranking:	S3

PMC July-06-2006, #234PMC Jul-13-2007#347, PMC Jul-14-2008#438, PMC Jul-30-2008#449

Carex sychnocephala (many-headed sedge)



Moisture:	Moist to wet
Habitat	Open disturbed sites, associated with mineral soils.
Distinguishing features:	Distinctly long bracts, resembling cotton grass; Perigynia 6-7 mm long, veined on lower portion, upper portion tapered into a long beak.
Similar Species:	None
Synonyms:	None
ACIMS ranking:	S3

Photo: SRL Jul-24-2009 #8237

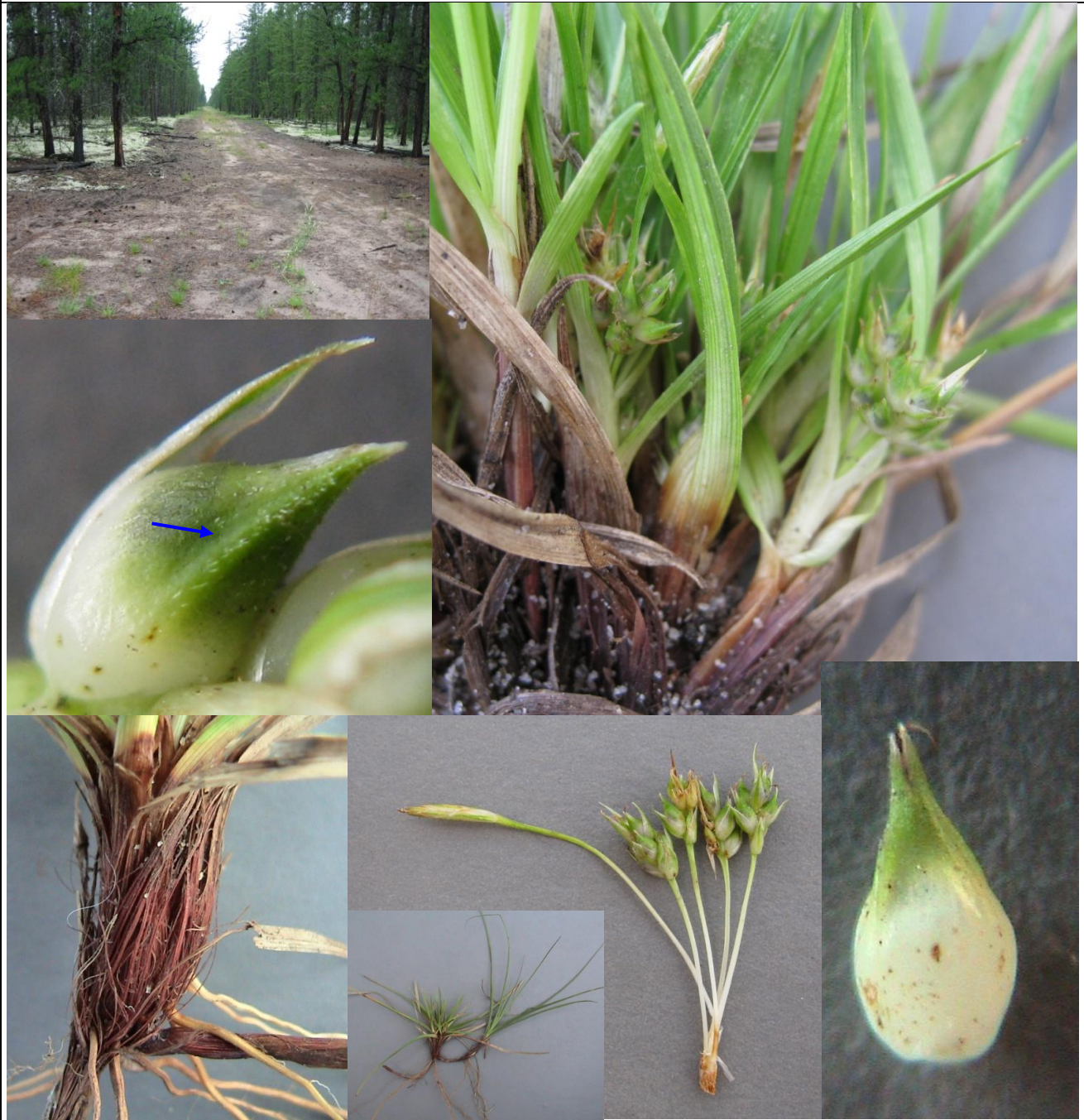
Carex tenuiflora (thin flowered sedge)



Moisture:	wet
Habitat	Fens and wet forests, associated with peat soils.
Distinguishing features:	Distinctly veined by late summer; straw coloured pistillate scales; almost always three crowded spikes per stem. Perigynia with two stigmas.
Similar Species:	<i>Carex loliacea</i> has similar perigynia, but spikes are separated.
Synonyms:	None
ACIMS ranking:	SES4

PMC Jun-21-2008#418 (base photo), PMC Aug-3-2004 #042, PMC Jun-22-2005#85

Carex tonsa (shaved sedge)



Moisture:	Dry
Habitat	Associated with sandy jack pine/lichen sites, usually on level ground
Distinguishing features:	Abundant basal spikes (i.e., spikes hidden in the stiff leathery leaves, few or no aerial spikes. Perigynia >3.2 mm, glabrous except for a few hairs on the keel (blue arrow).
Similar Species:	<i>Carex umbellata</i> , but this species has smaller pubescent perigynia <3.2 mm.
Synonyms:	(Note: this species not differentiated from <i>Carex umbellata</i> in Flora of Alberta)
ACIMS ranking:	S3

SRL July-20-2009#6750, PMC Jun-15-2006#199, PMC Jun-29-2008#426, Jul-27-2005#128

Carex trisperma (three-seeded sedge)



Moisture:	Moist to wet
Habitat	Fens margins, at edges with upland mineral soil
Distinguishing features:	Gynaecandrous spikes, <u>very long proximal bract</u> (red arrow) 2-4 cm, equal or exceeding the height of the inflorescence.
Similar Species:	<i>Carex disperma</i>
Synonyms:	None
ACIMS ranking:	S3

PMC Jul 1-2007 #340, PMC Sept 4-2006 #144

Carex umbellata (umbellate sedge)



Moisture:	Dry
Habitat	Associated with sandy open jack pine areas
Distinguishing features:	Leaves herbaceous. Perigynia 2.2 - 3.2 mm, beak short 0.4 -1.0 mm.
Similar Species:	<i>Carex tonsa</i> and <i>Carex rossii</i>
Synonyms:	<i>Carex abdita</i>
ACIMS ranking:	S2 Rare

SRL Jul-06-2009 #0886, 2808, 2816, 2835

Carex utriculata (beaked sedge)



Moisture:	Wet
Habitat	Marshes, streams and shorelines
Distinguishing features:	Inflated perigynia, pistillate scales narrower than body.
Similar Species:	<i>Carex rostrata</i>
Synonyms:	See entry under <i>Carex rostrata</i>
ACIMS ranking:	S5

PMC Jul-03-2004#004, PMC Oct-17-2005#158, PMC Jun-12-2010#538

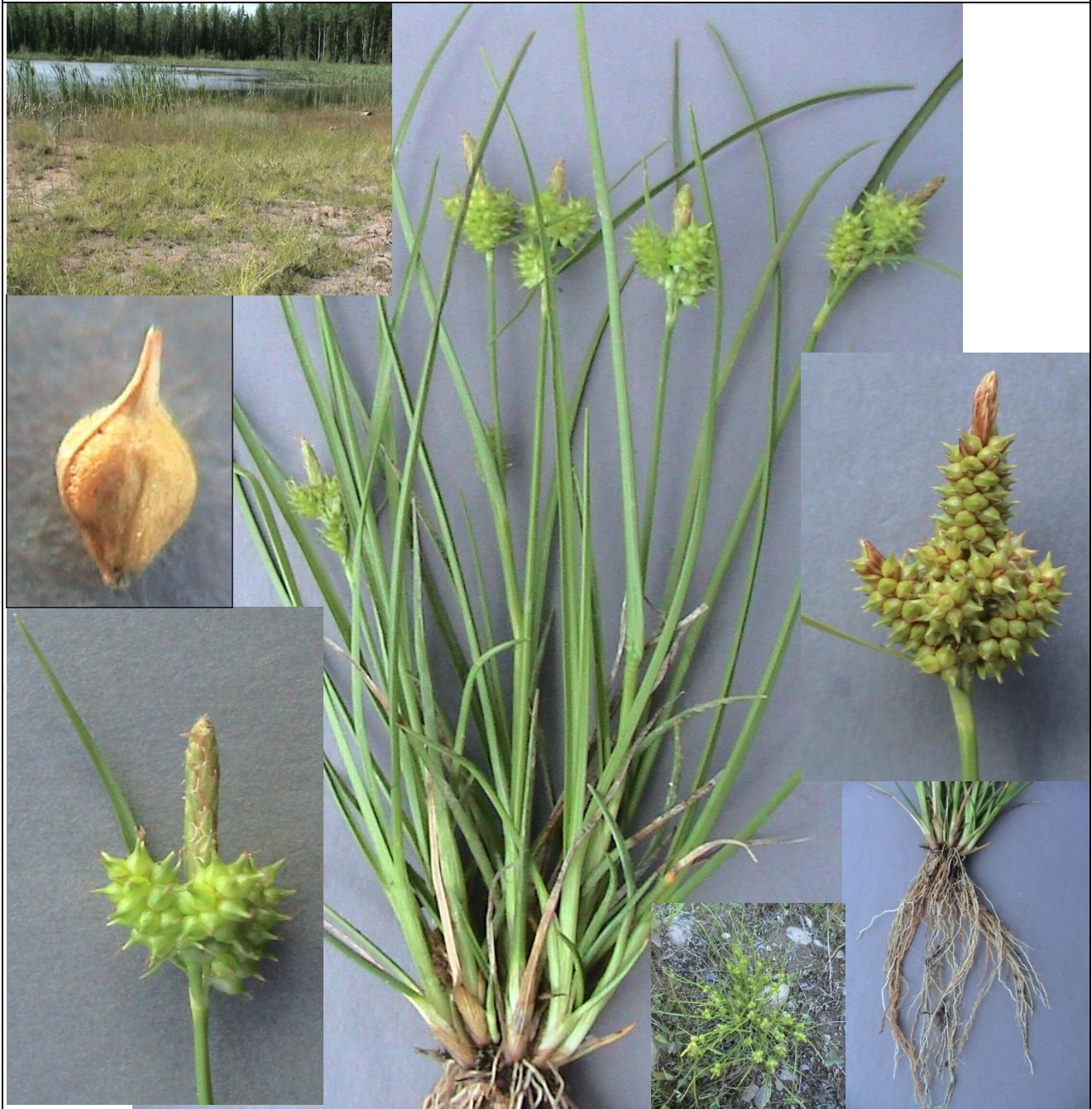
Carex vaginata (sheathed sedge)



Moisture:	Mesic to moist
Habitat	Openings in black spruce forest, but can also be found beneath balsam poplar trees in flood plains.
Distinguishing features:	Spike bracts are blade-like, distinctly long sheathing (red bracket), perigynia beak bent away from stem (appearing curved). Typically two spikes, well separated, erect or drooping.
Similar Species:	None
Synonyms:	None
ACIMS ranking:	S5

PMC Jun-21-2004#45, PMC May 25-2008#401, PMC Jun-02-2008#408, SRL Jul-22-2009#7193

Carex viridula (green sedge)



Moisture:	Moist to wet
Habitat	Open shorelines around marshes, disturbances
Distinguishing features:	Perigynia, the widest and roundest just under the beak; terminal spike staminate, with 2-3 tightly clustered pistillate spikes.
Similar Species:	None
Synonyms:	None
ACIMS ranking:	SES4

PMC Aug-28-2005#142, PAC Jul-01-2006#222, PAC Jun 14-2007#312

Carex vulpinoidea (fox sedge)



Moisture:	Moist
Habitat	Locations with stable moisture regime and near neutral pH. Found in the oil sands region growing on the windrow created by pipeline installation through a wet fen.
Distinguishing features:	Pear-shaped perigynia <3.2 mm, pistillate scales distinctly long awned (red arrow), spike bracts are hair-like. Ventral leaf sheath rugose (wrinkled).
Similar Species:	<i>Carex stipata</i>
Synonyms:	None
ACIMS ranking:	S2 RARE

Landscape and whole plant photographs (*) courtesy of Robert Grey, PAC Aug-07-2006#259

Bibliography and References

- ANHIC (Alberta Natural Heritage Information Centre). (2010). *List of all Species and Ecological Communities within the ANHIC Database - March, 2010*.
http://www.tpr.alberta.ca/parks/heritageinfocentre/datarequests/docs/List_of_All_Elements_MARCH_2010.xls
- Ball, P. W., Reznicek, A. A. & Murray, D. F. (2002). Carex. In Flora of North America Editorial Committee, (Eds.). *Flora of North America North of Mexico: Vol. 23, Magnolia: Commelinidae (in part): Cyperaceae* (pp. 254-572). New York, NY: Oxford University Press. http://www.efloras.org/florataxon.aspx?flora_id=1&taxon_id=105644
- Hudson, J. H. (1977). *Carex of Saskatchewan*. Saskatoon, Saskatchewan: Bison Publishing House.
- Johnson, B. C. (2001). Field guide to sedges of the Rocky Mountain Region: The genus Carex in Colorado, Wyoming, western South Dakota, western Nebraska, and western Kansas. Renewable Resources R2-RR-01-03. Denver, CO: U. S. Department of Agriculture, Forest Service, Rocky Mountain Region.
- Johnson, D., Kershaw, L., McKinnon A., & Pojar, J. (1995). *Plants of the western boreal forest and aspen parkland*. Edmonton, Alberta: Lone Pine Publishing.
- Kemper, J. T. (2009). *Alberta Natural Heritage Information Centre (ANHIC) Vascular and Non-Vascular Plant Tracking and Watch Lists*. Alberta Tourism, Park and Recreation, Parks Division, Edmonton, Alberta. [Note: ANHIC changed its name to ACIMS in April 2010.]
- Kershaw, L., Gould, J., Johnson, D. & Lancaster, J. (2001). *Rare Vascular Plants of Alberta*. Edmonton, Alberta: University of Alberta Press.
- Looman, J., & Best, K. F. (1979). *Budd's flora of the Canadian Prairie Provinces*. Hull, Quebec: Canadian Government Publishing Centre, Agriculture Canada, Research Branch.

- Marlowe, P.A. (2011). *Carex* establishment on reclaimed oil sands landscapes: A case study at Suncor Energy Inc. Unpublished master's thesis, Royal Roads University, Victoria, B.C., Canada. Royal Roads University DSpace: <http://hdl.handle.net/10170/407> or ProQuest Dissertations & Theses (in press) at: <http://proquest.umi.com>
- Ohlson, T. & Visallii, D. (2008). Taxonomic Study and Occurrence of *Carex atosquama*, *Carex heteroneura* var. *epapillosa* and *Carex heteroneura* var. *heteroneura* in North Central Washington. Retrieved Feb. 26, 2011 from <http://www.fs.fed.us/r6/sfpnw/issssp/documents/inventories/inv-rpt-va-carex-okw-taxonomic-study-and-occurrence-2008-10.pdf>
- Ohlson, T. (2009). 2009 ISSSSP Final Report on *Carex heteroneura* var. *epapillosa*, *Carex heteroneura* var. *heteroneura*, and *Carex atosquama* Taxonomic Study in North Central Washington, Okanogan-Wenatchee National Forest, Methow Valley Ranger District, Winthrop, Washington. Retrieved Feb-22-2011 from: <http://www.fs.fed.us/r6/sfpnw/issssp/documents/inventories/inv-rpt-va-carex-okw-taxonomic-study-2009.pdf>
- Packer, J.G. (2000). *Flora of Alberta*. Toronto, ON: University of Toronto Press.
- Porsild, A. E., Cody, W. J. (1980). *Vascular plants of continental Northwest Territories, Canada*. Ottawa: National Museum of Natural Sciences, National Museum of Canada.
- Wilson, B. Newhouse, B., Lytjen, D., Otting, N. & Brainerd, R. E. (2008). *Field guide to the sedges of the Pacific Northwest*. Corvallis, OR: Oregon State University Press.