



Photo Supplement

Carex Establishment on Reclaimed Oil
Sands Landscapes: A Case Study at
Suncor Energy Inc., April, 2011

Photo Supplement to the thesis

**Carex Establishment on Reclaimed Oil
Sands Landscapes (North East Alberta):
A case study at Suncor Energy Inc.**

Patricia A. Marlowe

April 2011

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.

A special thank you to Dr. Peter Ball for assisting with identification, and to Linda Curtis and Robert Grey for the use of their photographs. Their contribution was an immense help in making this publication possible.

For further information on the thesis please contact Patricia Marlowe at: Carexthesis@gmail.com. All questions welcomed!

Part I- *Carex adusta* to *loliacea*

Contents

Purpose and Limitations	i
<i>Carex adusta</i> (browned sedge)	1
<i>Carex aenea</i> (silvery-flowered sedge)	2
<i>Carex aquatilis</i> (water sedge)	3
<i>Carex aquatilis</i> (water sedge)- long scaled variety	4
<i>Carex atherodes</i> (awned sedge).....	5
<i>Carex aurea</i> (golden sedge).....	6
<i>Carex backii</i> (Back’s sedge).....	7
<i>Carex bebbii</i> (Bebb’s sedge).....	8
<i>Carex brunnescens</i> (brownish sedge).....	9
<i>Carex canescens</i> (short sedge).....	10
<i>Carex capillaris</i> (hair-like sedge)	11
<i>Carex capitata</i> (capitate sedge)	12
<i>Carex chordorrhiza</i> (prostrate sedge).....	13
<i>Carex concinna</i> (beautiful sedge sedge).....	14
<i>Carex crawfordii</i> (Crawford’s sedge).....	15
<i>Carex deflexa</i> (bent sedge)	16
<i>Carex deweyana</i> (Dewey’s sedge).....	17
<i>Carex diandra</i> (two-stamened sedge).....	18
<i>Carex disperma</i> (two-seeded sedge).....	19
<i>Carex duriuscula</i> (low sedge).....	20
<i>Carex gynocrates</i> (northern bog sedge).....	21
<i>Carex heleonastes</i> (Hudson Bay sedge)	22
<i>Carex houghtoniana</i> (sand sedge)	23
<i>Carex inops</i> subsp. <i>heliophila</i> (sun-loving sedge).....	24
<i>Carex interior</i> (inland sedge).....	25
<i>Carex lacustris</i> (lakeshore sedge).....	26
<i>Carex lasiocarpa</i> (hairy-fruited sedge).....	27
<i>Carex lenticularis</i> (lens-fruited sedge)	28
<i>Carex leptalea</i> (bristle-stalked sedge)	29
<i>Carex limosa</i> (mud sedge)	30
<i>Carex livida</i> (livid sedge)	31
<i>Carex loliacea</i> (rye-grass sedge)	32

Carex adusta (browned sedge)



Moisture:	Dry
Habitat	Openings in level sandy jack pine forests and disturbances
Distinguishing features:	Stems stiff and erect the entire length. Spike distinct, but not widely separated. Proximal (lowest) inflorescence bract is often filiform (needle-like) and can extend beyond the inflorescence, wide and cupping the base of spike (blue arrow). Ventral leaf sheath extends above collar (red bracket).
Similar Species:	<i>Carex aenea</i>
Synonyms:	None
ACIMS ranking:	S1 Rare

PMC Jul-21-2005#125, PMC Jun-29-2007#315, PMC Jun 28, 2008#424, PMC Jul-18-2008#434,

Carex aenea (silvery-flowered sedge)



Moisture:	Dry to mesic
Habitat	Forest openings, cutlines and disturbances
Distinguishing features:	Arched inflorescence, spikes well separated. Perigynia with flatten beak. Basal leaf sheaths often striate (striped).
Similar Species:	<i>Carex praticola</i> and <i>Carex adusta</i>
Synonyms:	<i>Carex foenea</i>
ACIMS ranking:	S4

PMC Aug-01-2007#363, SRL July 21-2009 #6694, SRL July 22-2009 #7335

Carex aquatilis (water sedge)



Moisture:	Wet to Flooded
Habitat	Edges of shorelines and wet meadows
Distinguishing features:	Numerous flattened perigynia on long upright spikes. Pistillate scale colour can vary from almost black to light brown. (See next page)
Similar Species:	<i>Carex lenticularis</i>
Synonyms:	None
ACIMS ranking:	S5

PMC Sep-17-2005#150, SRL Jul09-2009#9581, SRL Jul 23, 2009 #6758, SRL Jul 23, 2009 #7542 SRL Jul 23, 2009 #7540 (perigynia and dark pistillate scales), SRL Jul 24, 2009 #7751(left Perigynia with short pistillate scales)

Carex aquatilis (water sedge)- long scaled variety



Moisture:	Wet to Flooded
Habitat	Edges of shorelines and wet meadows
Distinguishing features:	Note: a variety with long acuminate pistillate scales is common in the Fort McMurray area. The lowest pistillate spike maybe pendent (dangling).
Similar Species:	<i>Carex lenticularis</i>
Synonyms:	None
ACIMS ranking:	S5

PMC Jul-28-2004#35, SRL Jul 23-2009 #7678

Carex atherodes (awned sedge)



Moisture:	Wet to Flooded
Habitat	Edges of shorelines and wet meadows
Distinguishing features:	In the Fort McMurray area ventral leaf sheaths are red and hairy. Perigynia with distinct V-shaped teeth on the beak of the perigynia (blue arrow).
Similar Species:	<i>Carex lacustris</i> and <i>Carex utriculata</i> .
Synonyms:	None
ACIMS ranking:	S5

PMC Jul-24-2004#34, PMC Oct-09-2005#157, PMC Jun-30-2005#108, SRL Jul-01-2009#8639SRL Jul-09-2009#9479

Carex aurea (golden sedge)



Moisture:	Moist to wet
Habitat	Mossy areas or areas with low vegetation cover, ditches and disturbances
Distinguishing features:	Blunt topped, beakless perigynia that turn distinctly golden orange in late summer.
Similar Species:	none
Synonyms:	none
ACIMS ranking:	S5

PMC Jun-14-2007#310, PMC July-19-2008#413

Carex backii (Back's sedge)



Moisture:	Mesic
Habitat	Openings in forests and disturbances, mineral soil.
Distinguishing features:	Pistillate scales are very large appearing like small leaves or leaf-like bracts. Tiny cigar shaped staminate spike (red arrow).
Similar Species:	None in the oil sands region
Synonyms:	None
ACIMS ranking:	S3

PMC Jun-13-2006#181, PMC Jun-23-2006 #214, PMC Aug-26-2006#266

Carex bebbii (Bebb's sedge)



Moisture:	Moist to wet
Habitat	Shorelines, wet forest openings
Distinguishing features:	Inflorescence in tight head-like clump, perigynia with an approximately 2:1 length to width ratio, usually greater than 1.2 mm in width
Similar Species:	<i>Carex crawfordii</i>
Synonyms:	none
ACIMS ranking:	S4

PAC Jun-17-2007#203, PAC Jul-01-2206 #225, PAC Jun-24-2007#328, PAC Jul-20-2008#442, SRLJul-21-2009#6646

Carex brunnescens (brownish sedge)



Moisture:	Wet to mesic
Habitat	Often found on peat soils, but present on mineral soils also.
Distinguishing features:	Greenish yellow with usually less than 15 perigynia per spike. Suture strip or silt in perigynia running from the top of the beak into the perigynia body (blue arrow).
Similar Species:	<i>Carex canescens</i>
Synonyms:	none
ACIMS ranking:	S4

PAC Jun-17-2005#83, PAC May-20-2006#174, PAC Jun-29-2007#335, PAC Jul-28-2007#361, PAC Aug-26-2009#539

Carex canescens (short sedge)



Moisture:	Moist to mesic
Habitat	Associated with peat soils
Distinguishing features:	Bluish green bloom to leaves and stems. No slit or suture strip on the perigynia beak, >20 perigynia per spike.
Similar Species:	<i>Carex brunnescens</i>
Synonyms:	none
ACIMS ranking:	S5

PMC Jun18, 2006 #205, SRL Jul-01-2009#8589, SRL Jul-07-2009#3649, 3650, 3728, 3741, SRL Jul-09-2009#9553

Carex capillaris (hair-like sedge)



Moisture:	Moist to mesic
Habitat	Found on peat and mineral soils.
Distinguishing features:	Pistillate spikes on thin long peduncles.
Similar Species:	None, but there are several varieties of <i>Carex capillaris</i> in the Fort McMurray area.
Synonyms:	none
ACIMS ranking:	S5

PAC May-28-2005#67, PAC Jun-23-2006#213, PCA Jun-14-2007#307, PCM Jun-05-2008#414, SRL Jun-23-2009#6948, 6980

Carex capitata (capitate sedge)



Moisture:	Moist
Habitat:	In the Fort McMurray this species found at the margins of fens in close association with upland sandy habitat (i.e., wet sandy soil).
Distinguishing features:	Pineapple-like appearance of inflorescence head. Ventral leaf sheath red spotted, may have a ciliate upper edge (blue arrow). Perigynia are flattened in cross-section (planoconvex or concave-convex).
Similar Species:	None
Synonyms:	None
ACIMS ranking:	S3 Tracking List

PCA Aug-19-2008#461, PMC Jun-21-2009#532

Carex chordorrhiza (prostrate sedge)



Moisture:	Wet
Habitat	Open fens, associated with peat soils
Distinguishing features:	Inflorescence generally in an elongated head formed from three tightly grouped spikes. Long stolons (old stems- red arrow) just under the moss surface, act as rhizomes. Distinct nodes on stems and stolons.
Similar Species:	<i>Carex gynocrates</i>
Synonyms:	None
ACIMS ranking:	S5

PAC Jul-04-2004#105, PAC Jun-21-2008#420, Pac #473

Carex concinna (beautiful sedge sedge)



Moisture:	Moist to dry
Habitat	Openings in forest and cutlines, generally on mineral soil
Distinguishing features:	Plants form dense circular flattened mounds. Proximal bracts short sheathing (red brackets) with short blade-like bract or bladeless. Pubescent (hairy) perigynia.
Similar Species:	None
Synonyms:	None
ACIMS ranking:	S5

PAC Jun-01-2006#178, PAC May-17-2007#287, PAC Aug-23-2008#462

Carex crawfordii (Crawford's sedge)



Moisture:	Wet to Mesic
Habitat	Disturbed areas, open shorelines, generally associated with mineral soils.
Distinguishing features:	Perigynia 1:3 to 1:4 width to length ratio, usually less than 1.3 mm in width.
Similar Species:	<i>Carex bebbii</i>
Synonyms:	None
ACIMS ranking:	S5

PMC Aug-29-2006#268, PMC Jul-01-2007#342, PMC Sept-21-2008#427, PMC Sep-11-2010#552

Carex deflexa (bent sedge)



Moisture:	Moist to dry
Habitat	Reported to be found in open dry forest, but also common on moist cutlines and burns
Distinguishing features:	Hairy perigynia <3.0 mm long, pistillate scales with distinct wide red edges. Staminate spike < 5 mm and hidden within pistillate spikes (black arrow). Basal spikes may be present (blue arrows).
Similar Species:	<i>Carex rossii</i> and <i>Carex peckii</i>
Synonyms:	None
ACIMS ranking:	S3

PMC May-27-2007#300, PMC Jun-07-2008#411

Carex deweyana (Dewey's sedge)



Moisture:	Mesic
Habitat:	Openings in wooded deciduous forests
Distinguishing features:	Inflorescence on long stems, stems reclining (laying on ground by fall), mature achene often visible through thin perigynia wall, pistillate scales awned or slightly awned tipped. Long filiform (needle-like) bract below lowest spikes.
Similar Species:	None
Synonyms:	None
ACIMS ranking:	S4

PMC Jul-03-2004#7, PMC Jun-30-2007#338, PMC Jul 5-2008#432, PMC May-31-2009#519

Carex diandra (two-stamened sedge)



Moisture:	Mesic
Habitat:	Shorelines, stream banks, wet meadows
Distinguishing features:	Suture strip (flap of tissue on perigynia beak-red bracket); Perigynia glossy; ventral leaf sheath translucent with fine red/brown spots (blue arrow).
Similar Species:	<i>Carex prairea</i>
Synonyms:	None
ACIMS ranking:	S5

PMC Jul-9-2005#117, PMC Jun-29-2007#311, PMC Nov-4-2007#380, SRL Jul 24-2009#8010, SRL Jul-09-2009#9557, SRL Jul-24-2009 #8384

Carex disperma (two-seeded sedge)



Moisture:	Moist
Habitat	Moist meadows, forest openings
Distinguishing features:	Perigynia in pairs or three's are glossy, rounded upper surface, nearly beakless. Lowest proximal bract, filiform, <2 cm, never exceeding inflorescence.
Similar Species:	<i>Carex trisperma</i>
Synonyms:	None
ACIMS ranking:	S5

PMC Jul-12-2006#247, PMC#Jun-03-2007#303, PMC Jun-30-2007#337

Carex duriuscula (low sedge)



Moisture:	Dry
Habitat	Steep, south facing slopes along the Athabasca River and tributaries. These areas near the crest of the slope, are too dry for trees and very few shrubs are present
Distinguishing features:	Inflorescence sometime curled in one direction (blue arrow). Spikes tightly packed. Large pistillate scales hide the perigynia. Perigynia are not pubescent.
Similar Species:	<i>Carex inops</i>
Synonyms:	<i>Carex Eleocharis</i> and <i>Carex stenophylla</i>
ACIMS ranking:	S5

PMC Jun-25-2007#326, SSG R003Jul-17-2009#0218, 0225, 5439, 5636 SSG R003May-03-2009#497-4258, SSG R008 Jun-07-2009#1576, 1558

Carex gynocrates (northern bog sedge)



Moisture:	Wet to moist
Habitat	Usually associated with peat soils.
Distinguishing features:	Under 30 cm in height (often much shorter), single spiked, species can be appear dioecious (male and female flowers on separate plants). Perigynia spreading horizontally at maturity.
Similar Species:	<i>Carex obtusata</i>
Synonyms:	<i>Carex dioica</i>
ACIMS ranking:	S5

PMC Jun-21-2004#51, PMC May-20-2007#293, PMC Jun-14-2007 #308, PMC Aug-23-2007#369, PMC Aug-26-2007#372, PMC Jun-27-2008#422

Carex heleonastes (Hudson Bay sedge)



Moisture:	Wet to moist
Habitat:	Usually associated with peat soils.
Distinguishing features:	Spikes <1 cm long. Pistillate scales with wide hyaline edges. leaves channeled, narrow 1 mm. Perigynia distinctly punctulate (dotted with tiny depressions) on surface.
Similar Species:	Carex lachenalii, but this species has not been reported in the oil sand region
Synonyms:	None
ACIMS ranking:	S2 RARE

PMC Aug-27-2009#540

Carex houghtoniana (sand sedge)



Moisture:	Dry
Habitat:	Usually associated with sandy soils and jackpine, on level ground or gentle slopes. Disturbances.
Distinguishing features:	Spikes well separated. Perigynia pubescent (hairy), >4.5 mm long, veins visible, leaves wide, flat to M-shaped in cross-section.
Similar Species:	<i>Carex lasiocarpa</i> and <i>Carex pellita</i>
Synonyms:	None
ACIMS ranking:	S3/S4

PMC Jun-16-2006#249, PMC Jun-29-2007#313, PMC Jun-28-2008#423

Carex inops subsp. *heliophila* (sun-loving sedge)



Moisture:	Dry
Habitat:	Steep, south facing slopes along the Athabasca River and tributaries. These areas near the crest of the slope, are too dry for trees and very few shrubs are present
Distinguishing features:	Pubescent 3-8 perigynia per spike, early blooming May, lowest pistillate spikes well separated, subtended by a filiform bract.
Similar Species:	<i>None</i>
Synonyms:	<i>Carex heliophila</i> and <i>Carex pensylvanica</i>
ACIMS ranking:	S4
Notes:	Perigynia varies from elongated near the city of Fort McMurray, to plump near Isadore Lake to the north.

PMC Jun-01-2009#521, SSG R003-July-17-2009, SSG R008 Jun-07-2009, SSG R009 Jun-07-2009

Carex interior (inland sedge)



Moisture:	Wet
Habitat:	Open areas along stream banks, marshes and in fens
Distinguishing features:	Perigynia often grouped in a star-like pattern, Spikes separated along the stem. Stem below first spike with male flowers, later appearing as empty scales (blue arrow).
Similar Species:	<i>Carex loliacea</i>
Synonyms:	None
ACIMS ranking:	S3

PMC Sep-11-2004#47, PMC Jul-01-2005#099, PMC Jun14-2007#305, PMC Aug-23-2007#370, PMC Jun-21-2008#417

Carex lacustris (lakeshore sedge)



Moisture:	Wet to flooded
Habitat:	Lakeshore, marshes and floating cattail islands
Distinguishing features:	Ventral leaf sheath breaks into ladder like fibers over time, leaf blades are M-shaped in cross-section. Tall up to 135 cm, leaves <21 mm wide, pistillate scales awned.
Similar Species:	<i>Carex atherodes</i>
Synonyms:	None
ACIMS ranking:	S2 RARE

Photographs of inflorescence in bloom and with mature spikes (*) are courtesy of Linda Curtis, PAC Aug-26-2007#373, Sep-19-2007#375

Carex lenticularis (lens-fruited sedge)

(no photos)

Moisture:	Wet
Habitat:	Edges of gravel or sandy streams
Distinguishing features:	Perigynia flattened and distinctly veined with a single male terminal spike. Lowest proximal bract shorter and never exceeding inflorescence in length.
Similar Species:	<i>Carex aquatilis</i>
Synonyms:	<i>Carex dolia</i> , <i>Carex enanderi</i> , <i>Carex kelloggii</i> or <i>Carex lipocarpa</i>
ACIMS ranking:	<i>Carex lenticularis</i> var. <i>dolia</i> (also called <i>Carex enanderi</i>) is ranked S1 RARE , while <i>Carex lenticularis</i> var. <i>lipocarpa</i> (also called <i>Carex kelloggii</i>) is ranked S3.
Notes:	<i>Carex lenticularis</i> subspecies <i>lenticularis</i> is reported in the Fort McMurray area.

Carex leptalea (bristle-stalked sedge)



Moisture:	Moist to wet
Habitat:	Associated with peat soils
Distinguishing features:	Perigynia resemble grains or rice, beakless. Pistillate scales shorter than perigynia and deciduous with age.
Similar Species:	None
Synonyms:	None
ACIMS ranking:	S5

PMC Jul-01-2005#97, PMC Jun13-2005#113, PMC Jun-12-2006#190, PMC Jun-23-2007#324, PMC July 22, 2008#443

Carex limosa (mud sedge)



Moisture:	Wet
Habitat:	Associated with peat soils
Distinguishing features:	Perigynia somewhat flattened and veined with one male terminal spike. Pistillate scales are same length or shorter than perigynia. Pistillate scales are persistent into the fall. Orange-felt like covering on roots.
Similar Species:	<i>Carex paupercula</i>
Synonyms:	None
ACIMS ranking:	S4

PMC Jun-05-2005#71, PMC Jul-01-2005#98, PMC Jun-18-2006#207, PMC Jun-14-2007#306

Carex livida (livid sedge)



Moisture:	Wet
Habitat:	Found in rich fens
Distinguishing features:	Single pistillate spike in V made between terminal staminate spike & bract, leaves & stem strongly glaucous (blue-waxy coating) on leaves.
Similar Species:	<i>Carex oligosperma</i>
Synonyms:	None
ACIMS ranking:	S3

PMC May23-2005#65, PMC Jul-01-2005#101

Carex loliacea (rye-grass sedge)



Moisture:	Wet
Habitat:	Swampy forests openings with little to no under-storey cover
Distinguishing features:	Spikes well separated on the stem; perigynia beakless and grouped in a star-like pattern.
Similar Species:	<i>Carex interior</i> and <i>Carex tenuiflora</i>
Synonyms:	None
ACIMS ranking:	S3

PMC 470, SNE Jul-01-2009 #2491, 2512, 2526, 8533, 8546

