

**Annapolis Atmosfarm Outreach Pilot Project  
A Clean Annapolis River Project Initiative  
Funded by Global Climate Change**

**Paul Jones  
June 2001**

# Table of Contents

## ***Introduction***

Acknowledgements	1
Introduction	2
How to use this Workbook	4

## ***Worksheets***

Worksheet #1: Energy Usage	7
Worksheet #2: Soil Management	12
Worksheet #3: Manure Management	16
Worksheet #4: Agri-Forestry	20
Worksheet #5: Riparian Zone	24
Worksheet #6: Fuel Efficiency	27
Worksheet #7: Greenhouse Gases	30

## ***Other Information***

Helpful Resources	34
NS Environmental Farm Plan Program	36
Questionnaire	38

## ***Fact Sheets***

Farm Energy: How to reduce your operating costs	41
Farm Electricity: Reduce and Save	43
Fuel Efficiency: Can we reduce the use?	44
Soil Organic Matter: The solution to all your soil needs	45
Soil management: How does it affect farms?	46
Soil Carbon: Benefiting Crops and the Environment	47
Manure and Methane: 100% Recyclable	48
Greenhouse Gases: How do they affect farmers?	50
Agri-Forestry: An investment for the future	51
Riparian Zone: How can we help?	52

## **Acknowledgements**

We would like to thank the Project Team Members for their generous support and contributions providing us with ideas, enthusiasm and information. We would also like to thank Climate Change Action Fund (CCAF) for their support of the Annapolis Atmosfarm Project.

Special thanks to Scott McCoombs, P. Eng. with the Nova Scotia Department of Natural Resources, Energy Utilization Section, and Dr. Joe Arbour with Environment Canada for their continued support throughout the project.

## Introduction

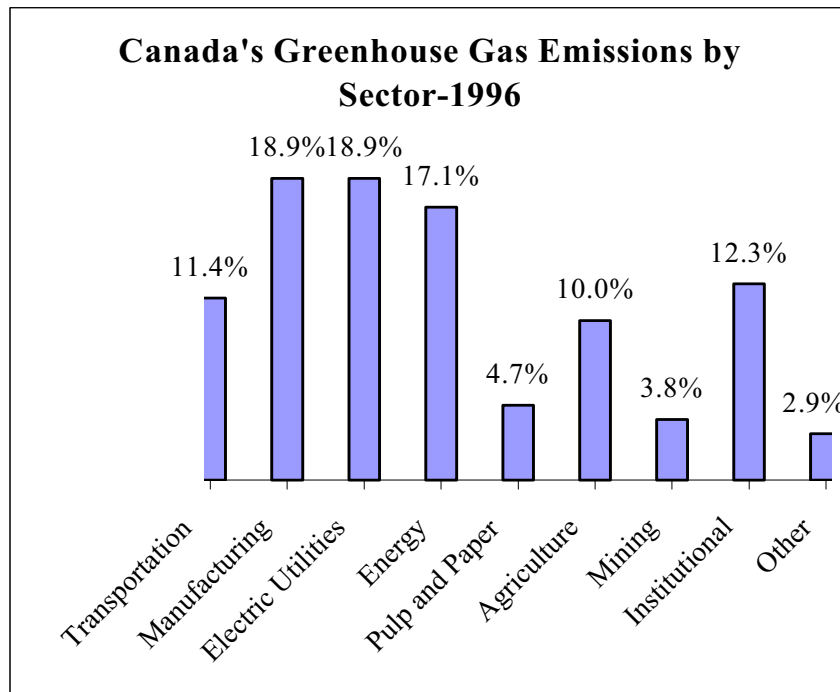
The Clean Annapolis River Project (CARP) is a charitable, non-governmental organization working with communities and organizations to foster the conservation, restoration and sustainable use of freshwater and marine ecosystems of the Annapolis Watershed. In 1991 CARP was invited to participate in the Atlantic Coastal Action Program (ACAP). CARP has initiated nearly 100 projects related to volunteer based water quality monitoring, environmental quality assessment, coastal zone management, fish habitat restoration, sustainable agriculture, environmental education and conservation planning. The association has been honoured with several regional and international environment awards and used as a model for community based environment management at local, regional, national and international levels.

In following this trend, the Annapolis Atmosfarm Outreach Pilot Project was created. Its goals are to reduce greenhouse gas emissions and to increase carbon sequestration on commercial farms in the Annapolis Valley of Nova Scotia. These methodologies will be transferable to other commercial farms across Canada.

The greenhouse gases of particular concern for this project are Methane (CH<sub>4</sub>), Nitrous Oxide (N<sub>2</sub>O) and Carbon Dioxide (CO<sub>2</sub>). Without these gases trapping the sun's heat the earth would freeze and life could not survive. On the other hand, if too many gases are released, the earth's temperature would rise and some major problems such as severe weather events, flooding, erosion and damage to our water resources could occur.

Agriculture contributes 60% of Canada's total Nitrous Oxide, 25% of methane and 4% of Carbon. Nitrous Oxide is released when chemical fertilizers are used and fossil fuels are burned. Methane is a gas produced when vegetation is burned, rotted or digested in the absence of Oxygen. One of the major sources of these emissions is the digestive system of grazing livestock. Finally, Carbon Dioxide is produced from the burning of fossil fuels. These practices occur on the farm regularly and it is difficult to run an efficient farm without them.

Over a 100-year period Methane has 21 times the global warming effect of Carbon Dioxide and Nitrous Oxide has 310 times the effect. Further, Nitrous Oxide has a life span of 170 years in the atmosphere and, once converted into Nitric Oxide (NO<sub>3</sub><sup>-</sup>) breaks down ozone, increasing the ultraviolet radiation that reaches the earth's surface.



This graph shows the greenhouse gas emissions by each sector for Canada in 1996. Agriculture produces 10% of the emissions; this is similar to the institutional and transportation sector.

The other area of concern for this project is Carbon sequestration on valley farms. By adding more carbon to the soil through the use of organic matter or cover crops the soil will be healthier and produce higher yields. Environment Canada claims that farmers can grow crops after the harvest to extract excess Nitric Oxide from the soil to prevent it from leaching or converting into Nitrous Oxide. Through various farm management practices the farmer will be able to add more organic matter to the soil, increase soil fertility, improve soil structure, increase crop yields and reduce emissions.

In 1995, Canada's agriculture sector contributed 63 million tonnes (9.2%) to Canada's total greenhouse gas emissions. The Annapolis Atmosfarm Outreach Pilot Project is addressing this situation. By working with farmers, the Atmosfarm Plans are being developed. If the suggestions are followed, these plans will benefit both the environment and the farmer.

## How to use this Workbook

This workbook is designed to provide easily attainable information to help with the operating process of the farm. Each section examines a different topic and how it applies to both the environment and the farmer.

The section is further divided into issues, relevant to farming operations. For each issue place a checkmark in the box that applies to you. Add up the total checkmarks at the end of the worksheet and follow the advice offered based on your score.

Example:

### Energy Usage

### Worksheet #1

ISSUE #1

Lighting

Timers, dimmers, photo or motion sensor lights are being used	<input checked="" type="checkbox"/>
Fluorescent or High intensity discharge (HID) light systems are being used	<input type="checkbox"/>
Banks of lights are on different switches to avoid using unnecessary lights	<input type="checkbox"/>

1/3

If you use timers, dimmers, photo or motion sensor lights place a checkmark in the column adjacent to it. This is one point.

# **Worksheets**





## Energy Usage - Worksheet #1

All farms use energy, some more than others. Depending on the type of farm, and how energy efficient it is, many expenses are fixed and cannot be altered. However, operating costs are an expense over which the farmer has some control. Being energy conscience is the key to saving money. It will make a difference on your energy, fuel and water bills.

The burning of fossil fuels to produce energy releases greenhouse gases into the atmosphere. By using energy more efficiently, the farmer benefits by lowering operating costs and the environment benefits with lower emissions.

There are many operations that use energy: lighting, heating, plowing, tillage, refrigeration, application of manure and fertilizers and many more. This worksheet explores tasks on the farm in which energy can be used more efficiently.



### What Can You Do?

1. Find out how much, and where, energy is currently being used on the farm.
2. Find out where you can make use of energy efficient methods.
3. Use the worksheet to discover suggestions on using energy more efficiently.

**ISSUE #1 - Use of Fuel**

The size of the tractor is matched to the size of implements according to the owner's manual	
There is more than one operation carried out in each tillage pass	
The practice of "gear-up, throttle-down" driving is being used	
The tires are inflated properly	
The tractor has radial tires	

/5

**ISSUE #2 - Maintenance of Machinery**

The recommended maintenance schedule, according to operators manual, for machinery is being followed	
Preventative maintenance is being carried out	
Equipment is routinely examined for wear and tear	

/3

**ISSUE #3 - Energy Usage**

An energy survey or audit has been conducted on the farm	
Energy use is monitored for each operation	
All equipment is cleaned and well maintained	

/3

**ISSUE #4 - Crop Energy Input**

The crops are dried in the field	
Low temperature drying or natural air drying is used	
The soil is tested at least every 2 to 3 years	
The manure is tested before application	
The method of crop rotation is used	
Livestock or green manure is used instead of chemical fertilizers	

/6

**ISSUE #5 - Heated Buildings**

Walls and ceiling have insulation	
There is a continuous air/vapour barrier	
The doors and windows are tight fitting	
There is caulking and weather stripping in the building	
There is some shade on the building by trees or other obstacles	

/5

**ISSUE #6 - Cold Storage**

It is a designed cooling system	
There is a fast cool down before cold storage	
There is a plastic door strip	
The equipment is well maintained	

/4

**ISSUE #7 - Lighting**

Timers, dimmers, photo or motion sensor lights are being used	
Fluorescent or High Intensity Discharge (HID) light systems are being used	
Banks of lights are on different switches to avoid using unnecessary lights	

/3

Total for this worksheet: \_\_\_\_\_ /29

**20-29:** Congratulations! You are using energy efficiently.

**0-19:** There are ways in which you can reduce energy costs on the farm. Please see the fact sheets entitled; Farm energy: How to reduce your farm operating costs and Farm Electricity: Reduce and Save

**For more information please contact:**

Nova Scotia Power Inc: Phone: 1-800-428-6230  
[www.nspower.ca](http://www.nspower.ca)

Light Better...for Less: Phone: 1-800-670-4636  
Fax: 1-902-424-2763  
[www.gov.ns.ca/natr/meb/light.htm](http://www.gov.ns.ca/natr/meb/light.htm)

---

**NOTES**

## Soil Management - Worksheet #2

Soil management is a very important aspect of farming. Healthy soil should be crumbly with many pore spaces, show no sign of crusting or compacting and allow the roots to grow freely within it. Also, there should be a minimum amount of water left on the surface after a rainfall.

A good soil management program should protect the soil from erosion by wind and water and maintain, or improve, the quality of soil.

Nitrogen is a very important nutrient to crops, helping to accentuate growth and produce a healthy green crop. However, a plant can only use so much Nitrogen and excessive amounts will not benefit the crop. Instead, the excess Nitrogen will be released into the atmosphere as Nitrous Oxide, which will add to the greenhouse gas effect. These emissions are a concern to farmers because it represents lost Nitrogen from the soil.

Organic matter (Carbon) in the soil helps to prevent erosion by wind and water, soil crusting and compaction. Organic matter provides important nutrients for the crop and helps make herbicides more effective. This worksheet will explore areas of soil management that can help increase crop yields while reducing greenhouse gas emissions.



### What Can You Do?

1. Look for places on your land where soil erosion may occur and take precautions to help prevent it.
2. Use cover crops to increase the amount of organic matter in the soil.
3. Use the worksheet to discover suggestions on how to increase the soil organic matter and reduce the amount of Nitrous Oxide emissions.

**ISSUE #1 - Healthy Soil**

A minimum amount of water remains on the field after a rainfall	
Soil is crumbly with many pore spaces	
Soil is dark, contains many earthworms and has organic matter present	
Soil does not show any sign of compacting or crusting	
Roots grow freely within the soil	
Measures have been taken to protect against soil erosion	

/6

**ISSUE #2 - Soil Carbon**

Cover crops are used on the field	
A crop rotation is used	
Soil is tested at least every 2 to 3 years	
When conducting a soil test, a portion of soil is selected from different areas on the field and mixed together into one soil sample.	
Manure is applied to the soil in early spring before planting	
Crop residue, straw, hay or mulch is spread on the soil surface after harvest	
The practice of summer fallow has been eliminated	

/7

**ISSUE # 3 - Tillage**

Tillage depth is up to 10 cm but never in the subsoil	
The recommended speed, according to operators manual, is used for the operation	
Currently using no or low-tillage practices	
Multiple tasks are carried out during one tillage pass	

/4

**ISSUE #4 - Nitrous Oxide Emissions**

When applying fertilizers, additions are matched to that of the plant needs	
Nitrogen is applied so crops can attain maximum yield without leaving behind any available Nitrogen	
Manure is applied at rates that just supply plant demands	
Nitrogen is applied at a time when crops can take it up immediately	
Crops are watered only when necessary and in amounts that will not be excessive	

/5

Total for this worksheet: \_\_\_\_\_ /22

**14-23:** Congratulations! Your farm has a good soil management plan

**0-14:** There are ways you can improve your soil quality, for more information please see the fact sheets entitled; Soil Organic Matter: The solution to all your soil need, Soil Management: How does it affect farms? and Soil Carbon: Benefiting crops and the Environment



**For more information contact:**

Nova Scotia Organic Growers Association (NSOGA):

Phone: (902) 632-2497	
3101 Hwy 236 RR#1	<a href="http://www.gks.com/NSOGA">www.gks.com/NSOGA</a>
Kennetcook, NS	Email: <a href="mailto:NSOGA@gks.com">NSOGA@gks.com</a>
BON 1P0	

Eastern Canada Soil and Water Conservation Centre

Eastern Canada Soil and	Phone: (506) 475-4040
Water Conservation Centre	Fax: (506) 475-4030
1010 ch de l'Église	<a href="http://www.ccse-swcc.nb.ca">www.ccse-swcc.nb.ca</a>
Grand Falls, NB	Email: <a href="mailto:ccse-swcc@cuslm.ca">ccse-swcc@cuslm.ca</a>
E3Y 2X9	

NS Dept of Agriculture & Marketing - [www.agri.gov.ns.ca](http://www.agri.gov.ns.ca)

Truro	Kentville
PO Box 550	Agricultural Center
Truro, NS B2N 5E3	Kentville, NS B4N 1J5
Phone (902) 893-6600	Phone (902) 679-6000

---

**NOTES**

## **Manure Management - Worksheet#3**

Poultry and livestock manure is a very valuable resource and is one of the best sources of nutrients for crop production. When applied to cropland, manure provides valuable nutrients and organic matter to the soil. It also helps build up poor soils, reduce erosion, increase crop yields and stimulate biological activity in soil.

Microbes decompose manure, producing gaseous by-products including Methane and Carbon Dioxide. These gases are released into the atmosphere and contribute to global warming and the greenhouse effect.



Through careful management practices these emissions can be reduced and the manure more properly managed. This worksheet examines manure management and offers suggestions on how to better utilize this valuable resource.

### **What Can You Do?**

Have your manure tested before applying to crops to determine what nutrients are present. This will help determine what should be added to the field to best suit the plant needs.

Determine the methods of applying manure to your land that will most benefit crops. Weather conditions, time of day and type of manure applied all affect the amount of nutrients the crop receives.

Use the worksheet to discover suggestions on how to manage and utilize manure.

**ISSUE #1 - Soil Conditions when Manure is Applied**

Soil is dry enough to cultivate	
No surface cracks are present	
Low risk of soil compaction	
Soil test conducted before applying manure	

/4

**ISSUE #2 - Manure Storage**

Storage facilities are adequate enough to hold manure (and rain or snow) for 180-250 days	
Manure is stacked on concrete, asphalt or other impermeable base	
Storage has a roof	
Storage contains or prevents all liquid run off	
Concrete or steel tanks show no signs of cracks or leaks	
Manure is not stored in a field or on bare soil	

/6

**ISSUE #3 - Methane and Manure**

Solid manure is composted	
Naturally aerated lagoons or oxidation ponds are used	
Moisture levels are controlled	

/3

**ISSUE #4 - Manure Application**

A manure test is conducted regularly	
Manure is applied on a cool, cloudy afternoon	
There is no risk of rain in the next 24 hours.	
It is incorporated into the soil soon after spreading	
It is applied at a rate that just meets the plant needs	

/5

Total for this worksheet: \_\_\_\_\_ /18

**10-18:** Congratulations! Your farm had a good Manure Management plan

**9-0:** Did you know that Manure is 100% recyclable? For more information please see the fact sheet entitled; Manure and Methane: 100% Recyclable

**For more information please contact:**

Department of Agriculture & Marketing (For manure analysis) Plant Industry Branch Analytical Services Section  
PO Box 550  
Truro, NS  
B2N 5E3

Ecological Agriculture Project, McGill University  
Phone: (514) 398-7771  
Fax (514) 398-7621

ManureNet Canada      [res2.agr.ca/initiatives/manurenet](http://res2.agr.ca/initiatives/manurenet)

Nova Scotia Department of Agriculture and Marketing

---

**NOTES**

## Agri-Forestry – Worksheet #4

Trees planted on the farm can develop into profit for the farmer while helping to reduce Greenhouse Gas emissions. This provides a benefit to the farmer and the environment. A tree consumes a lot of Carbon Dioxide during its' lifetime, reducing the amount of gas that enters the atmosphere. This will provide a great benefit to the environment.

The key to a successful cash crop in this type of business is to manage it as an investment. Fertilize, water and prune the trees regularly to ensure maximum growth. A better price will be offered for a healthy crop.



### What Can You Do?

1. Plant some hardwood trees on your farm as an investment for the future.
2. Fertilize, water and prune your trees regularly to ensure maximum growth.
3. Use this worksheet to discover suggestion on Agri-Forestry.

**ISSUE #1 - Agri-Forestry**

Trees have been planted along the edge of the field	
Trees have been planted within the last 3 years	
Trees are spaced 2 to 3 meters apart	
Hardwood trees have been planted	

/4

**ISSUE #2 - Windbreaks and shelter**

Trees are growing along the edge of a field	
Trees are used as a windbreak beside the house and / or barn	
Trees provide shade to livestock, barns or houses	
A shelter belt is present on the farm land	

/4

**ISSUE #3 - Forestry Management**

Lost trees have been re-planted	
Trees have mulch around the trunk base	
Trees are monitored for insects and disease	
Trees are watered, fertilized and pruned.	

/4

### ISSUE #4 - Tree Planting

All roots are fanned out below ground level	
The planting hole is deep enough for all roots	
There are no air pockets in the soil around the roots	
The soil is at the level of the root collar on the tree	
The trunk is straight and the tree is firmly pressed in the ground	

/5

Total for this worksheet: \_\_\_\_\_ /17

**12-17:** Congratulations! You are using this valuable resource well

**0-11:** Did you know one large tree could replace enough polluted air for four people to breathe for one day?  
Please see the fact sheet entitled; Agri-Forestry: An investment for the future.



**For more information please contact:**

Department of Natural Resources Office

Nova Scotia East Woodlands Office

529 Valleydale Road  
Truro, NS  
B2N 5C5

Phone: (902) 895-4451  
Fax: (902) 895-9909

Nova Scotia West Woodlands Office

Weymouth Falls Road  
Weymouth, NS  
B0W 3T0

Phone: (902) 837-5182  
Fax: (902) 837-7408

---

**NOTES**

## Riparian Zone - Worksheet #5

The riparian zone is the area between the edge of a body of water and the land. This important section offers protection from wind and water erosion by trapping sediment along the water's edge. Trees, shrubs and other riparian vegetation can act as a windbreak for farmland helping to reduce soil erosion.

A well-managed riparian zone provides numerous benefits to the cattle. Livestock fenced out of the water spend more time feeding, less time in wet and muddy conditions and are cleaner in the barn. Herds have fewer colds, reduced incidence of mastitis and less foot rot. By protecting this zone the farmer will be protecting the cattle.



The environment benefits from this section in many ways. The foliage provides shade on the water, critical for fish and aquatic life to survive. The riparian zone provides a nesting ground for birds and ducks, a feeding area for wildlife and a location for aquatic mammals such as beaver and turtles to make their dens. An important aspect of this zone is the vegetation present that is taking up Carbon Dioxide normally expelled into the atmosphere.

### What Can You Do?

1. Examine the river edge on your property to determine if you have a healthy riparian zone.
2. Keep the area fenced off to protect both livestock and the river.
3. Use the worksheet to discover suggestion on creating and maintaining a healthy riparian zone.

**ISSUE #1 - Riparian Zone**

There is shade for fish and other aquatic life along the water edge	
There is healthy vegetation (trees, shrubs, grass, plants) growing along the river bank	
A wide variety of plants and animals are present in this section	
There is no evidence of erosion along the water's edge	

/4

**ISSUE #2 - Maintaining Riparian Zone**

Livestock have been fenced out of the river	
An alternate water source is available for cattle	
Feed and salt blocks are kept away from the river	
Excessive amounts of water are not taken from the river	
Farm water run-off, containing fertilizer, manure or chemicals, does not enter the stream	
Farm operations do not disturb the soil or water quality	

/6

Total for this worksheet: \_\_\_\_\_ /10

**6-10:** Congratulations! You have a healthy riparian zone.

**0-5:** Did you know that keeping livestock out of waterways will help both the environment and the cattle? For more information please see the fact sheet entitled; Riparian Zone: How can we help?

**For more information please contact:**

Ducks Unlimited Canada  
9 Havelick Street  
Amherst, Nova Scotia  
B4H 3J6

Phone: (902) 667-8726  
webfoot@ducks.ca  
www.ducks.ca

Nova Scotia Department of Agriculture and Marketing

Nova Scotia Department of Natural Resources

---

**NOTES**

## Fuel Efficiency - Worksheet #6

Burning fossil fuels to produce energy releases greenhouse gases into the atmosphere. This accounts for 80-85% of all Carbon Dioxide emissions produced. Reducing fuel usage, or using it more efficiently will reduce gas emissions and fuel costs. In short, saving fuel means saving money.

If we continue the way we are going, humans will be responsible for doubling the amount of carbon dioxide in the air before the year 2050.

Many scientists now believe that the addition of carbon dioxide into the air is throwing our atmosphere and the natural greenhouse effect out of balance. This will lead to global warming which would be devastating to farmers.



### What Can You Do?

1. Determine how much fuel is currently being used for farm operations.
2. Make an effort to reduce the amount of fuel used
3. Use the worksheet to discover suggestions on how you can use fuel more efficiently

**ISSUE #1 - Machinery Efficiency**

A recommended maintenance schedule, according to the operators manual is followed	
Machinery is inspected regularly for wear and tear	
Radial tires are used	
Tires are inflated properly for the operation according to . . .	

/4

**ISSUE #2 - Fuel Efficiency**

More than one operation is carried out with each tillage pass	
Tractor size matches the size of the implements, according to the operators manual	
The driving practice of “gear-up-throttle-down” is used	
An effort is made to reduce fuel use on the farm	

/4

Total for this worksheet: \_\_\_\_\_ /8

**5-8:** Congratulations! You are using fuel efficiently.

**0-4:** Did you know that many of the practices used for fuel efficiency will help contribute to larger profits? For more information please see the fact sheet entitled; Fuel Efficiency: Can we reduce the use?

**For more information please contact:**

Environment Canada

Inquiry Centre  
Ottawa, Ontario  
K1A 0H3

1-800-668-6767

The Atlantic Green Lane

[www.ns.ec.gc.ca/index.html](http://www.ns.ec.gc.ca/index.html)

---

**NOTES**

## Greenhouse Gases - Worksheet #7

In 1995, Canada's agriculture sector contributed 63 million tonnes (9.2 %) to Canada's total greenhouse gas emissions. If this trend continues the earth will warm and climate changes will occur. Mild winters and hot dry summers will be devastating for farmers and their livelihood. Steps must be taken to ensure a healthy sustainable future for agriculture.

The greenhouse gases of most concern to farmers are Nitrous Oxide (N<sub>2</sub>O), Methane (CH<sub>4</sub>) and Carbon Dioxide (CO<sub>2</sub>). Although there are other greenhouse gases, these three make up 90% of the total emissions.

The suggestions offered to reduce gas emissions will also help reduce operating costs.



### What Can You Do?

1. Develop an understanding of the greenhouse gases and how they are produced
2. Make an effort to reduce emissions
3. Use the worksheet to discover suggestions on reducing greenhouse gas emissions from the farm.



**ISSUE #1 - Nitrous Oxide**

Fertilizers are applied in amounts that just meet the needs of the plant	
Slow release Nitrogen fertilizers are used	
Nitrogen is applied at a time when crops can take it up immediately	
Manure is applied in amounts that just meet the needs of the plant	
Improvements have been made in soil aeration	
Water is applied only when necessary in amounts that will not be excessive	
Cover crops are used	
Neutralizing agents such as lime are added to acidic soils	

/8

**ISSUE #2 - Methane from Vegetation and Manure**

Vegetation is not burned on the farm	
Manure is not stored for long periods of time without composting, aerating or using proper storage facilities	
Manure storage tanks are kept cool	
Methane is used as a fuel	
The manure pile is aerated or turned regularly	

/5

**ISSUE #3 - Methane from digestion of Feed**

Feed is easily digestible such as grains, legumes and /or silage	
The feed is chopped into smaller fragments	
Edible oils are added to feed	
Minimal amounts of fibrous grasses and hays are consumed by cattle	

/4

**ISSUE #4 - Carbon Dioxide**

The practice of no or low-tillage is used on the farm	
More than one operation is carried out with each pass	
Many trees are present on the farmstead	
The practice of summer fallow has been eliminated	
A conscience effort is made to reduce fuel consumption	
Organic Matter is added to the soil	

/6

Total for this worksheet: \_\_\_\_\_ /23

**14-23:** Congratulations! You are helping to reduce greenhouse gas emissions.

**0-13:** Did you know a 1% increase in soil organic matter equates to over 40 tonnes of Carbon Dioxide removed from the atmosphere per hectare of farm land? For more information please see the fact sheet entitled; Greenhouse Gases: How do they affect farmers?

**For more information please contact:**

Environment Canada  
45 Aderney Drive  
Dartmouth, NS  
B2Y 2N6

phone: (902) 426-7231  
[www.ns.ec.gc.ca](http://www.ns.ec.gc.ca)

---

**NOTES**

## Helpful Resources

### Nova Scotia Organic Growers Association

NSOGA 3101 Hwy 236 RR#1 Kennetcook, NS B0N 1P0	Phone: (902) 632-2497 <a href="http://www.gks.com/NSOGA">www.gks.com/NSOGA</a> <a href="mailto:NSOGA@gks.com">NSOGA@gks.com</a>
---	---

### Eastern Canada Soil and Water Conservation Centre

1010 ch de l'Église Grand Falls, NB E3Y 2X9	Phone (506) 475-4040 Fax: (506) 475-4030 <a href="http://www.ccse-swcc.nb.ca">www.ccse-swcc.nb.ca</a> <a href="mailto:ccse-swcc@cuslm.ca">ccse-swcc@cuslm.ca</a>
---	---

### Environment Canada

45 Alderney Drive Dartmouth, NS B2Y 2N6	Phone: (902) 426-7231 <a href="http://www.ns.cc.gc.ca">www.ns.cc.gc.ca</a>
---	---

### Nova Scotia Power Inc.

Phone: 1-800-428-6230  
[www.nspower.ca](http://www.nspower.ca)

### Light Better... for Less

Phone: 1-800-670-4636  
Fax (902) 424-2763  
[www.gov.ns.ca/natr/meb/light.htm](http://www.gov.ns.ca/natr/meb/light.htm)

### Nova Scotia Department of Natural Resources

Kentville: Provincial Building 136 Exhibition Street, Kentville, Nova Scotia B4N 4E5	Phone: 679-6097 Fax: 679-6176 <a href="http://www.gov.ns.ca/natr/">www.gov.ns.ca/natr/</a>
--	--

Nova Scotia Department of Agriculture and Marketing

Kentville Agricultural Centre	Phone: (902) 679-6000
Kentville, N.S.	Fax: (902) 679-6062
B4N 1J5	<a href="http://www.agri.gov.ns.ca">www.agri.gov.ns.ca</a>

Nova Scotia Federation of Agriculture

PO Box 784	Phone: (902) 893-2293
Truro, NS	Fax: (902) 893-7063
B2N 5E8	

Agriculture and Agri-Food Canada - Public Information Request Service

Sir John Carling Building	Tel.: (613) 759-1000
930 Carling Ave	Fax: (613) 759-6726
Ottawa, Ontario	<a href="mailto:PIRS@em.agr.ca">PIRS@em.agr.ca</a>
K1A 0C5	<a href="http://www.agr.ca">www.agr.ca</a>

## **NS Environmental Farm Plan Program**

### **Overview**

The Environmental Farm Plan Program is a voluntary initiative that helps farmers identify and manage environmental risk on their property. It allows farmers to incorporate environmental considerations into their business decision making process, rather than addressing environmental issues on an ad hoc basis.

There is no cost associated in working with the Environmental Farm Plan Coordinator in developing an environmental farm plan for your operation. It is a service provided by the Nova Scotia Federation of Agriculture.

### The Environmental Farm Plan Process

#### Initial Farm Visit

The first step in developing an environmental farm plan is to look at the environmental expectations and goals of the farm. During this initial farm visit, we will get an overview of the farm operation and ask the farmer to prepare a simple map of the farm prior to our next visit.

During the on-farm review, we look at:

1. Water Use and Management
2. Farm Waste Management
3. Nutrient Management
  - 3.1 Manure Storage and Handling
  - 3.2 Fertilizer Storage and Use
4. Fuel Storage and Handling
5. Pesticide Management
6. Livestock Production
7. Soil Management
8. Prevention of Nuisance

### **On-Farm Environmental Review**

The second step is going through the on-farm environmental review to identify and evaluate environmental risk. The Environmental Farm Plan Coordinator and an Agricultural Engineer from the Resource Stewardship Branch of the Nova Scotia Department of the Agriculture and Marketing coordinate the on-farm environmental reviews with the farm manager. Each participant, including the farmer, is involved in identifying potential areas of environmental risk, defining practical solutions to minimize the risk and locating resources to implement the action plan.

### **Document Review Findings**

Once the on-farm environmental review is completed, the findings are documented and an environmental action plan is prepared.

### **Present Review Findings to the Farmer**

The findings report, complete with an action plan is presented to the farmer for discussion. The farm manager must be comfortable with the content of the report and timeframe of completing action items.

### **Follow Up**

It is the responsibility of the farm manager to implement any or all of the actions suggested. The Environmental Farm Plan Coordinator will be available to assist you in implementing the action plan.

### **Contact Information**

If you are interested in a confidential on-farm environmental review or holding an information session in your area, please contact the NS Federation of Agriculture office in Truro at 893-2293.

## Questionnaire

Please take a few minutes to complete the following survey and mail or fax it back to us at:

Clean Annapolis River Project  
PO Box 395 Annapolis Royal, NS  
B0S 1A0  
Fax (902) 532-3038

Your Name: \_\_\_\_\_  
Your Address: \_\_\_\_\_  
Your Phone Number: \_\_\_\_\_

---

1. Was the workbook easy to follow and understand?

Yes       No      Comments:

2. Was the workbook helpful in providing suggestions and ideas on reducing your greenhouse gas reductions?

Yes       No      Comments:

3a. Will you make any changes on your farm based on the findings of the workbook?

Yes       No

3b. If so what changes will be made?

4. Would you be willing to make some changes if funding was available?

Yes       No

5. Any comments or questions?



# **FACT SHEETS**





## Farm Energy: How to reduce your operating costs

By using energy more efficiently farmers are able to reduce farm operating costs, save energy and reduce greenhouse gas emissions. The following suggestions will benefit both the farmer and the environment.

### Lighting and Heat Lamps:

- Convert to a more efficient light source. For example, fluorescent bulbs use 60% to 80% less energy than incandescent bulbs and last 10 times longer.
- Timers, dimmers, light sensors or motion sensors will help operate lighting more efficiently.
- Use High pressure sodium or High Intensity Discharge (HID) light sources for outdoor lighting.
- Light only the work area being used instead of the entire barn or building.
- Heat lamps should be checked and adjusted regularly for maximum efficiency and safety.

### Water Heater:

- Set the water heater's thermostat as low as possible, while still maintaining required sanitation standards.
- If water is not needed for long periods of time turn electricity to the heating elements off.
- Ensure a proper maintenance schedule for the unit and carry out all repairs promptly.
- An insulating blanket secured to the hot water heater can help reduce heat loss and can save approximately \$20 per year on energy (according to Nova Scotia Power Inc.).
- Insulate hot water pipes to reduce heat loss.

### Poultry Processing:

- In poultry areas, dehumidification can be accomplished with a heat pump or by using a heat recovery system to the air conditioning system. The reclaimed heat can be used for the water heating system.

### Cold Storage:

- Ensure a regular maintenance schedule for the storage unit.
- Insulate and seal the cold storage unit.
- Monitor the temperature to ensure efficient operation.
- Position a plastic door strip around the door to help reduce air exchange when the unit is open.

### **Insulation:**

- Air seal buildings around the doors and windows.
- Insulate all hot water pipes.
- Ensure that windows and doors fit tightly.
- Seal the building with caulking and weather-stripping.
- Place insulation in walls to help hold in the heat.

### **Grain Dryer:**

- Inspect drying floor and related facilities regularly to ensure free air flow.
- Avoid overdrying by checking moisture content of grain frequently.
- Add a heat recovery system to reuse heat from the drying equipment.
- Use a good moisture tester and ensure grain is dried to recommended levels.
- If possible, allow crops to air dry in the field.
- Install full floor aeration to allow safe bin storage of dry grain products.

### **Other ideas:**

- Always choose a motor that is the right size for the job at hand, avoid oversizing or undersizing the motor.
- Consider using a more energy efficient motor for new replacements.
- Consider a two speed motor with variable speed drives for variable flow required.
- If the electric fence is not being used, unplug it to save energy.
- Keep accurate records of past energy use for various equipment to determine where energy saving steps can be made.



## Farm Electricity

### Reduce and save!

#### Did you Know:

- In Canada, climate change is expected to be greater than in most other countries, with the mean annual temperature rising between 5 and 10 °C over the next century.
- Scientists predict that the Earth's average temperature will rise another 1 to 3.5 °C by the year 2100.
- Global warming cannot be stopped or reversed, but it should be slowed down to allow the natural environment and human society to adapt.
- The 20th century has been the warmest in the past 1200 years, with 1997 and 1998 being the hottest years on record.
- If current emission trends continue, concentrations of CO<sub>2</sub> in the atmosphere are expected to at least double during the 21st century.

#### What is Farm Energy?

Farm energy is the electrical energy that the farm consumes over a period of time. In the day to day operations of a farm the cost of running the various equipment can lead to a high power bill. There are many different operations on the farm that require electricity to work; some of these are lighting, pumps, fans, conveyors and cooling units. Some of these operations are left running for considerable amounts of time. Lighting and fans are sometimes left on for entire days at a time. Reducing the power used will reduce the cost to the farmer and protect the environment.

#### Why should farmers be concerned?

Farmers should be concerned because the use of inefficient equipment will lead to high power bills which lead to loss of revenue.

#### Ways to help

- Insulate all necessary pipes through the farm.
- Wipe down lights with a damp cloth once a year to help light efficiency.
- Keep all motors free of dust and dirt to prevent over heating.
- If the farm is on demand rate, if possible avoid simultaneous use of large loads.
- Ensure farm equipment is running efficiently. This will reduce power and fuel consumption and also reduce time lost to maintenance.
- Switching to a more efficient lighting system can produce significantly reduced power bills.
- Replace incandescent lighting with fluorescent or high intensity discharge (HID).
- Use timers to reduce unnecessary energy consumption.



## **Fuel Efficiency**

### **Can we reduce the use?**

#### **Why should farmers be concerned?**

This change in the earth's climate is largely the result of burning fossil fuels, such as coal and oil, to power our buildings, industries and transportation. Climate scientists' best guess is that the rate of warming we are currently experiencing is much faster than at any other time in the past 10,000 years. Such a rapid change is likely to produce more extreme weather, rising sea levels that erode coastal areas and contaminate fresh water supplies, threats to agriculture and wildlife, and public health risks from infectious disease and heat deaths.

#### **Ways to help**

- One of the most important things you can do to reduce global warming pollution and greenhouse gases is to purchase machinery with higher fuel economy. This is because every gallon of gasoline your machinery burns puts 20 pounds of carbon dioxide, a greenhouse gas pollutant, into the atmosphere.
- The Tractor size should match the size of the implement
- More than one operation could be carried out with each pass
- Fuel consumption can be reduced by driving practices of “Gear-up throttle down”
- A maintenance schedule of machinery and an examination of equipment periodically for wear and tear should be carried out.



## Soil Organic Matter: The solution to all your soil needs

### What is Soil Organic Matter?

Soil Organic Matter is a very important component of soils, consisting of dead and decaying materials such as straw, leaves, roots, plants and animal matter. It also contains living microbes that help break down residues producing humus, a component of healthy soil. Soil organic matter can help reduce greenhouse gas emissions, especially Nitrous Oxide.

### What is healthy soil?

Healthy soil is dark brown with many pore spaces, crumbly, shows no sign of compacting and allows roots to grow freely within it. Also, there should be a minimum amount of water left on the surface after a rainfall. Healthy soil produces higher yields, contains more nutrients available for crops and requires less fertilizer.

### How does Soil Organic Matter benefit the soil?

Soil organic matter benefits the soil by

- maintaining aeration
- improving soil drainage
- helping to reduce weeds
- fixing and retaining more Nitrogen
- providing nutrients for crops
- promoting water retention
- reducing erosion
- feeding soil organisms
- creating good soil structure

Soil Organic Matter has been referred to as *“the solution to all your soil problems”*.

### What are some methods of adding soil organic matter?

Cover Crops such as grass or legumes can add nutrients and organic matter to soil when left on the field to decompose. Sod forming grass or grass-legume mixtures are some of the best cover crops. The contribution of organic matter from a green manure crop is comparable to the addition of 9 to 13 tonnes per acre of farmyard manure.

Mulches placed on bare soil are a great way to control weeds, retain moisture and protect the soil. Straw, seaweed, hay, leaves or grass clippings are all great mulches. As these materials break down they provide nutrients and organic matter to the soil.

Manure provides valuable nutrients such as Nitrogen, Potassium, Carbon and Phosphorus. Solid manure often contains straw or hay which helps add organic matter.



## Soil Management

### How does it affect farms?

#### Did you Know

- Organic matter acts as a stabilizer allowing more water to penetrate the soil instead of running off
- Nova Scotia has rolling topography, many cropped fields have slopes greater than 4%
- 80% of erosion occurs during winter and spring
- Bare fields can lose up to 50 tonnes per hectare per year of topsoil
- Nova Scotia's topsoil is very shallow; between 200 to 400 mm
- With a loss of 4mm a year from a bare soil, all topsoil can be lost within 50 years

#### Why should farmers be concerned?

Farmers should be concerned for their soils. The loss, compaction and lack of valuable nutrients in the soil contribute to the soils death. Leaving the soil unusable and unproductive.

#### What is Soil Management?

Soil management is a very important aspect of farming. The longevity and yield of a field can be increased by a well-maintained and healthy soil. A good soil management program should protect the soil from erosion by wind and water. A good management program will reduce the amount of compaction that the soil is subjected to. Healthy soil should be crumbly with lots of pore space, show no sign of crusting or compacting and allow the roots to grow freely within it. A healthy soil should have a minimum amount of water left on the surface after a rainfall.

#### Ways to help the soil.

- To prevent soil erosion cover crops can be planted after harvest in the fall. This will help hold the soil and keep the soil on the land, out of waterways and off other fields.
- In the prevention of soil erosion straw mulch applied over the field or incorporated into the soil will prevent loss of topsoil and nutrients.
- Low or no-tillage can prevent erosion by lowering the number of passes over the soil and the amount of time that the soil is exposed to the elements
- Low or no-tillage can prevent compaction of the soil, which causes run off from rain water. This prevents water from entering the soil. Compaction increases the difficulty of the roots moving through the soil causing plant stress.
- Windbreaks slow down wind preventing it from carrying away topsoil.
- Different plowing techniques, such as contour plowing, slow down the running water preventing topsoil from washing away.





# Soil Carbon:

## Benefiting crops and the Environment

### Methods for adding soil Carbon:

#### Low or no-tillage:

Reducing the amount of tillage protects the Carbon inside soil particles and keeps residues on the surface where they can decay more slowly. An added benefit to the practice of low or no-tillage is the prevention of soil erosion and a reduction in fuel.

#### Cover crops:

Cover crops provide soil organic matter to the soil and when broken down release Carbon that is picked up by the soil particles. Perennial forage crops, such as grasses, can trap more Carbon Dioxide than annual crops because they have a longer growing season. As an added benefit, perennial crops have an extensive root system that places the Carbon below ground where it is better protected.

#### Plant trees:

Trees are used on farms as windbreaks and shelterbelts. The trees absorb Carbon Dioxide from the air reducing the amount left in the atmosphere. It is estimated that typical shelterbelt trees contain 162 to 544 kg of Carbon, with poplar trees having the most.

#### Add nutrients:

Adding manure or fertilizer not only adds Carbon to the soil but also helps reduce soil erosion and increase crop yields. A soil test should first be conducted to determine the level of nutrients already present to avoid over application. Excess nutrients cut into farm profits and leach into the water and air, harming the environment.

#### Eliminate summer fallow:

Leaving land unplanted for a growing season results in a loss of soil Carbon because no new residues are added. Also, summer fallow exposes the soil to wind and water erosion.

#### Other ideas:

- Avoid burning crop residues, this releases Carbon Dioxide into the atmosphere and reduces the amount of Carbon added to the soil.
- Use higher yielding crops or varieties. These produce more residues therefore increasing soil Carbon.

## Manure & Methane



100% Recyclable

# Manure and Methane

## What is Manure?

Manure is a by-product of all livestock operations. This resource contains nutrients and organic matter that can be recycled through the farming operation to supplement soil and crop productivity. If not managed properly, manure may promote environmental contamination, soil compaction, fly problems and reduce farm profits.

## What is Methane?

Methane is a colourless, odourless gas (at room temperature). Methane is the simplest of a class of compounds called alkanes. Methane is produced by bacterial breakdown.

## Methane Emissions

The biological breakdown of manure produces Methane, ammonia, hydrogen sulphide and other compounds such as mercaptans and amines. Combinations of these compounds can produce greenhouse gases and offensive odours at very small concentrations (parts per billion). The types of compounds produced depend on the types of biological processes that take place.

## What Causes Emissions?

Bacteria, which are found in manure, are responsible for creating odorous gases as they break down organic material. Aerobic bacteria, which require oxygen to survive, produce mostly carbon dioxide which is essentially odourless. Anaerobic bacteria, which thrive in the absence of oxygen, tend to produce odorous compounds such as ammonia and hydrogen sulphide. The type of bacteria present may vary at different locations throughout the manure. Generally, aerobic bacteria are located near the surface, while anaerobic bacteria are beneath the surface. Temperature controls the rate of bacterial action. The higher the temperature, the faster the biological action and therefore the greater the gas production. This explains the fact that fewer odours are produced in cold weather conditions.

Moisture is required for biological activity to take place. The bacterial activity slows and can be stopped as manure is dried. Moisture also makes anaerobic conditions more likely in the manure and thereby encourages the activity of odour-causing anaerobic bacteria.

---

## Ways to help - Examples of Manure Treatment

### Aerobic Methods

Composting solid manure reduces odours. By mixing or ventilating, oxygen is mixed with the manure. This keeps conditions in the manure aerobic so odours are not produced. Composting can be done simply by turning a pile with a loader or in more complex vessel systems. Composted manure is more stable than untreated manure and can often be sold off the farm as a value added product.

Naturally aerated lagoons or oxidation ponds are typically large shallow ponds which rely on water surface and atmospheric interaction to keep conditions aerobic.

### Anaerobic Methods

Anaerobic ponds are one example, where crusting keeps the surface sealed.

Methane digesters are another example of anaerobic treatment process where manure is treated in an enclosed vessel at a constant temperature which is ideal for methane production (very expensive).

### Other Methods

Moisture Removal By reducing the moisture level, odour production is also reduced.

### Did you know?

- In Nova Scotia there are more than 1,860 livestock operations
- Livestock odours are as much a social problem as they are a technical problem
- Bacteria which are found in manure are responsible for creating gases
- Most methane and odour causing gases are formed when manure is in storage
- Typically fewer gases are produced by solid manure
- More than 1.6 million tonnes of manure is produced annually in Nova Scotia
- Kings and Digby counties are the areas in the province with the largest manure production per unit land area available for manure application



## Greenhouse Gases: How do they affect farmers ?

### Did you know:

- In 1995, Canada's agriculture sector contributed 27.6 million tonnes (4.5%) to Canada's total greenhouse gas emissions.
- One large tree can replace enough polluted air with clean air for four people to breathe for one day?
- The burning of fossil fuels accounts for 80-85% of carbon dioxide emissions.
- Weather-stripping and caulking around windows and doors will help reduce your fuel bills and greenhouse gas emissions.

### What are greenhouse gases?

Methane, Carbon Dioxide and Nitrous Oxide are three of the greenhouse gases farmers are concerned with.

Methane gas is produced when vegetation is burned, digested or rotted in the absence of Oxygen. Manure, cattle and fossil fuels emit Methane gas.

Carbon Dioxide is produced from the burning of fossil fuels and deforestation.

Nitrous Oxide is released from chemical fertilizer, manure and the burning of fossil fuels.

Many of the practices suggested for reducing greenhouse gas emissions will also help reduce energy bills and operating costs.

### Why should farmers be concerned?

As greenhouse gases continue to warm the earth, climate changes will occur. Mild winters and hot dry summers will be devastating for farmers and their livelihood.

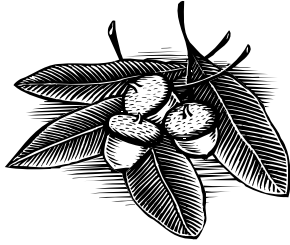
### Ways of reducing Greenhouse Gas Emissions on the farm:

- Use easily digestible feed, add edible oils, chop feed or minimize the use of fibrous grasses and hays. This will speed up the digestion time of the cattle and reduce Methane emissions.
- Replace less efficient incandescent bulbs with fluorescent or high intensity discharge (HID) bulbs.
- Combine operations when doing field work to maximize field productivity and minimize fuel use.
- Match fertilizer additions to crop needs. Apply just enough Nitrogen fertilizer to benefit the plants without leaving any behind.
- Reduce tillage intensity. This will reduce Nitrous Oxide and Carbon Dioxide emissions.



## Agri-Forestry: An investment for the future

- High value hardwood trees such as Red Maple, Sugar Maple or Black Walnut can develop into profit for the farmer, if properly managed. The key to a successful crop of high value furniture wood is to fertilize, water and prune the trees regularly to ensure maximum growth. A better price will be offered for a healthy crop.
- A row of trees planted along the edge of the property will provide a windbreak for barns and houses. This will help reduce energy costs associated with the heating of buildings.
- One large tree can replace enough polluted air with clean air for four people to breathe for one day.
- Trees planted as a windbreak along the edge of a field can protect against soil erosion by reducing wind and trapping sediment.
- Trees provide shade for livestock in the field and in the barn, providing better comfort for cattle and less need for fans or air conditioning during the summer months.
- Trees help reduce greenhouse gas emissions. They consume large amounts of Carbon Dioxide during their early stages of development and continue to absorb Carbon Dioxide during their lifetime, reducing the amount released into the atmosphere. Less Carbon Dioxide released into the atmosphere decreases the risk of global warming.
- Trees planted along the water's edge, also known as the riparian zone, provide many benefits to the environment including:
  - shade for animals and fish
  - feeding area for wildlife
  - helping to prevent soil erosion
  - nesting ground for ducks and birds
  - site for aquatic animals to make their den



## **Riparian Zone: How can we help?**

### **Riparian Zone**

Streamside forests once protected most of the rivers and streams of the Maritimes, but deforestation brought about by agriculture and urban expansion has drastically reduced the extent of stream bank protected by forests. The result has often been a lowering of the quality of water for human consumption and recreation as well as an overall decline in aquatic habitat. These problems have, in part, been linked to contamination from excessive nutrients, sedimentation and other pollutants associated with agriculture practices, and to a lesser degree, by forestry activities.

An increasing number of landowners have realized that riparian buffers are crucial for the protection and enhancement of water resources. As such, buffers represent a vital component of an integrated land management system which includes nutrient management and sediment and erosion control and nutrient management.

### **What do Riparian Zones do?**

#### **Protect Against Stream Heating**

The magnitude of the temperature increase is generally proportional to the increase in exposure of the stream to solar radiation.

#### **Prevention of Stream Sedimentation**

Sediment is generally considered the most widespread pollutant in streams from agriculture and forested watersheds.

#### **Control of Nutrient Run-off**

When supplying fertilizers in concentrations which exceed the requirements for plant growth they often end up in waterways.

#### **Protection and Enhancement of the Aquatic Habitat**

Leaves, twigs, fruit and insects that fall from the forest canopy are critical to the processes within streams and are rapidly consumed.

### **Buffer Facts:**

- Streamside buffers should be used in conjunction with sound land management systems that include and sediment and erosion control and nutrient management.
- The first step to establishing buffers is the identification of hazards to the riparian environment from planned activities. From this information, buffer strips can be planned as to their nature, extent and width.
- The buffer must be wide enough to filter sediment from surface runoff.
- Riparian buffers should be managed to maintain a stable streamside ecosystem and prevent erosion.
- The following activities should be avoided within buffers: excessive use of fertilizers, pesticides, or other chemicals, vehicular traffic or excessive pedestrian traffic and removal of or disturbance of vegetation and litter inconsistent with erosion control and buffering objectives.

Riparian buffers represent a low cost solution for controlling non-point pollution sources. They can also be managed to return tangible benefits such as wood fibre. Managing riparian buffers can thus contribute to the landowners economic well-being.