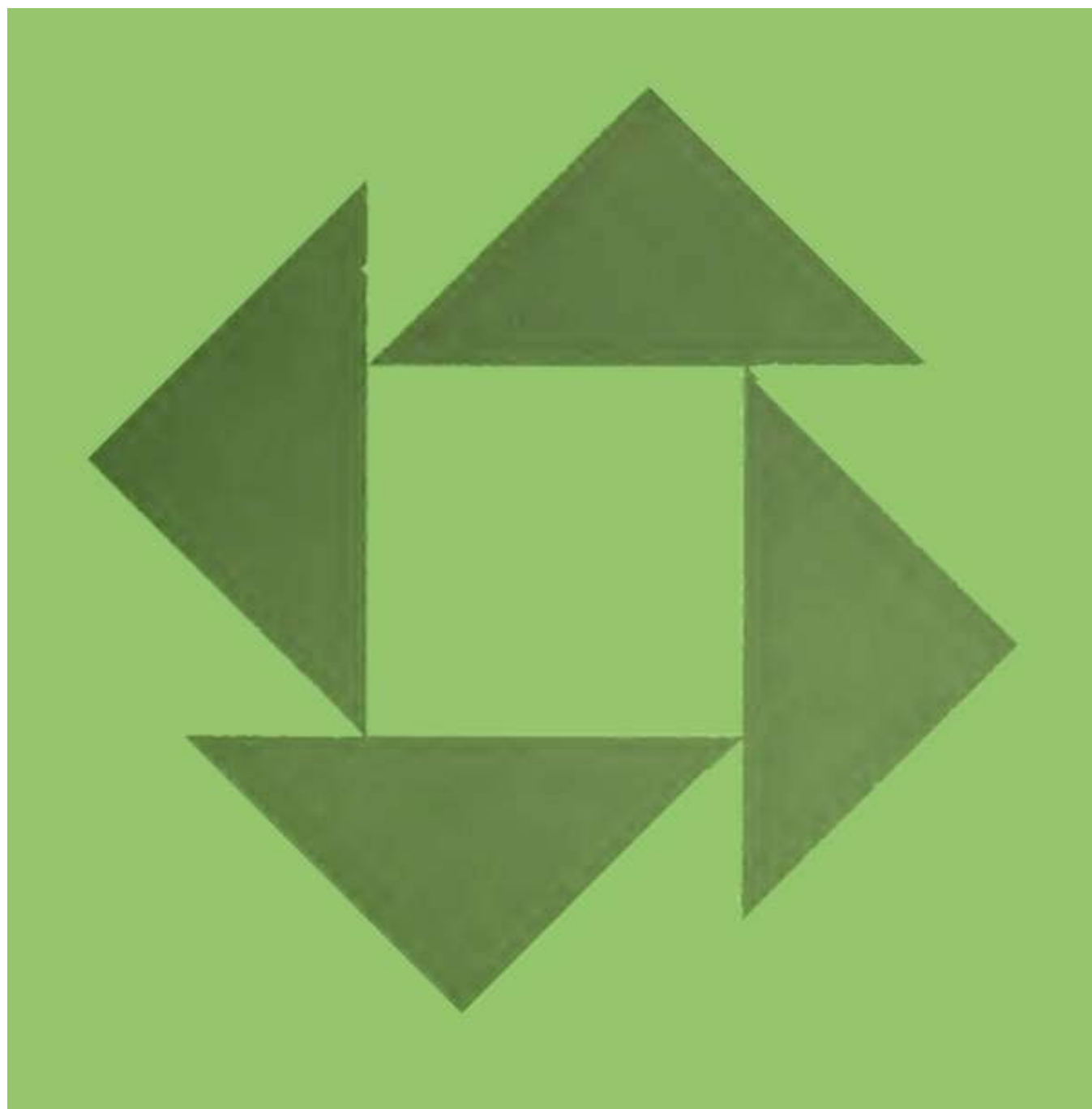


Farmstead planning



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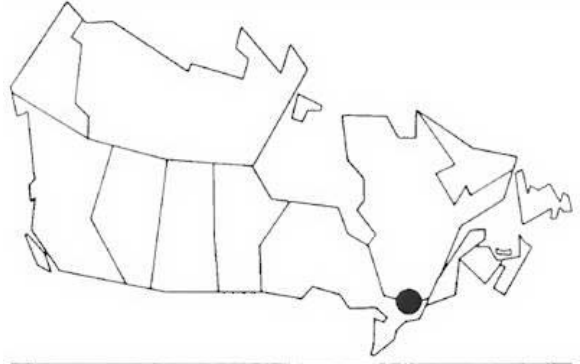
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FARMSTEAD PLANNING

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CONTENTS

PLANNING FACTORS	3
Water supply	3
Services	3
Fire prevention	5
Security	6
Space	6
HOW TO PLAN ACTIVITY ZONES	6
Zone 1 — Family living	6
Zone 2 — Machinery storage and service	6
Zone 3 — Grain handling and storage, and small animal buildings	7
Zone 4 — Major livestock facilities	8
TOPOGRAPHY	8
Slopes	8
Subsurface drainage	8
SOIL	9
CLIMATE	9
Wind	9
Precipitation	9
Sun	10
INCREASING SIZE	11
OFF-FARM FACTORS	13
STEPS IN PREPARING A PLAN	13
Prepare site plan	13
Evaluate existing buildings	13
Establish your needs and goals	13
Locate your activities	13
Try alternate layouts	14
Draw in contour lines	14
Finish your plan	14
FARMSTEAD AND LIVESTOCK SHELTERBELTS	14
Benefits of shelterbelts	14
Planning shelterbelts	14
ACKNOWLEDGMENT	17

FARMSTEAD PLANNING

PLANNING FACTORS

If you plan to improve or expand your farmstead, or build a new one from scratch, you have to consider a number of factors before you begin. These impose limitations; if one is overlooked your plans might not work out.

Water Supply

Water of good quality is essential to a farmstead. Investigate to ensure, beyond doubt, that enough is available before you start any other farmstead development. Analyze your needs, taking into account both present conditions and future requirements. The water source can be a drilled well, dugout, dam or spring. If a dugout is required, it should be large and deep enough to allow for evaporation losses and facilitate effective algae and weed control. Dams and dugouts must be located where they will collect enough runoff to refill each spring. If an adequate supply of good water is not available, find another location.

Services

Road Access — Ready access to municipal roads and provincial highways is important. Don't locate the farmstead too far from a public road, or you'll have to build and maintain an all-weather private lane at your own expense. Snow removal in winter can be a major problem.

All legal land parcels are bordered by a public road right-of-way on at least one side, and in some cases, on two. This can restrict the laying out of a farmstead. The house should be the first building seen (or approached) when entering the farmstead for both appearance and traffic control. Regardless of where the farmstead is situated, choose the site for the house first and locate all other buildings in relation to it.

You might consider having two entrances to the farmstead, one to the house and another to the main activity area. Such an arrangement reduces traffic, dust and noise around the house, but uninvited visitors are more difficult to detect. Figure 1 shows some basic layouts for farmsteads located on different sides of public roads. Only major activity centers are illustrated. Remember that location of the farmstead is also determined by other factors, such as drainage, electric and water lines, sewage system, and topography.

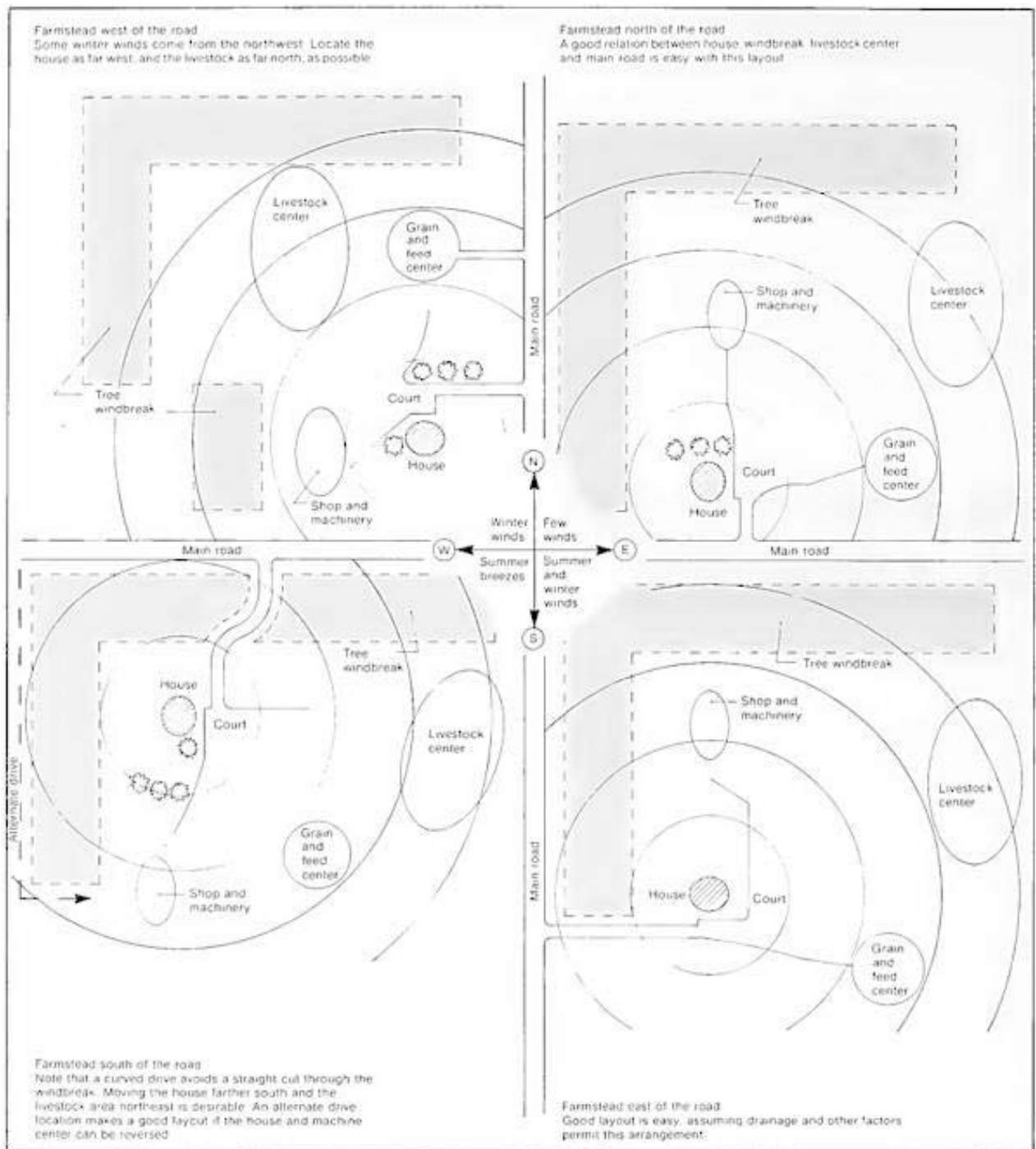


Figure 1 — Farmstead and main road relationships.

If you install a gate at the entrance, place it at least 12 to 18 m from the road so vehicles have room to stop while the gate is being opened. Build the drive about 5 m wide with at least 2 m of additional clearance on each side; the extra width allows for large overhanging equipment and snow storage. Drains along the drive can be within this 2 m (Figure 2).

Trim hedges low or eliminate them completely at intersections. Don't have traffic lanes that end in blind exits to other traffic areas, roads or highways.

Properly planned parking can prevent traffic congestion. If your farmstead has no space for a visitor to park, he may leave his car in the drive, blocking farm and emergency vehicles. Encourage visitors to use your houseguest entrance by

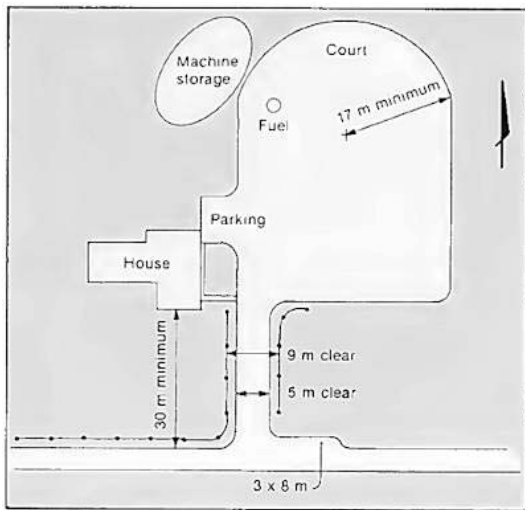


Figure 2 — Planning driveways and courts.

providing obvious parking for three to five cars and a direct walkway to the door. Parking is usually on the side of the drive nearest the house.

The farmstead court is an extension of the main drive. Plan for easy parking and manoeuvring of vehicles and machinery. Good drainage ensures year-round use, and yard lights give safety, convenience and security. Extra space, either grassed or gravelled, allows temporary vehicle storage.

A common layout is a loop drive connecting the various activity zones, with an open space in the center for overflow parking. A large truck needs about 17 m radius to turn, so the drive should have a diameter of at least 34 m. Develop a layout that allows trucks to service the grain and livestock areas with a minimum of backing up. This may require more surfaced drive, but access to buildings, space to manoeuvre large vehicles, fire safety, and room for expansion are all improved.

Electricity and gas — Electricity and gas are your main source of power. Plan installation carefully to ensure adequate supplies are available when and where you need them. If you are planning a new installation, an extension, or replacing an existing line, consider underground line placement. To prevent damage and avoid injury during future excavations, mark all underground installations, including natural gas lines, on the surface; place an easily seen marker at each end, and at each bend or corner.

Telephones — The telephone is an important tool for most farm businesses. Consider installing more than one phone, so business calls can be handled without returning to the house. A radio unit in the house combined with mobile units on

some vehicles and machinery could also save you valuable time in your operation.

Be sure you know where cable is buried, so you will not cut it while developing the farmstead. If an addition or renovation involves disturbing the cable, give advance notice to the telephone company. Otherwise, your building schedule could be delayed.

Fire prevention

Prevent fires, by having adequate wiring, efficient lightning protection, and proper storage of fuels. Also, avoid causes of spontaneous combustion and practice good housekeeping. To reduce the hazard of fire:

- ▶ Use fire-resistant building materials.
- ▶ Locate water hydrants (on 32 mm water line) adjacent to barns and feed-storage areas.
- ▶ Install the water system on a separate power circuit which runs directly from the transformer pole.
- ▶ Locate chemical fire extinguishers adjacent to grain-drying equipment, welders, fuel storage, and in barns and vehicles.
- ▶ Space buildings properly (see Table 1).
- ▶ Put alarm systems in buildings such as confinement livestock housing, automatic feed processing, and grain-drying units.
- ▶ Keep grass mowed in yards and around buildings.

Table 1. Typical building spacing to prevent fire spread due to radiation.

Building type	Dimension of building (overall height and length)	Distance to adjacent structure
High hazard		
Fuel storage	3 m x 4 m	12 m
Hay storage	3 m x 15 m	21 m
Crop drying	3 m x 30 m	30 m
Feed processing	6 m x 9 m	24 m
Barn with furnace	6 m x 15 m	30 m
Moderate Hazard		
Storage		
Silage and grain	3 m x 4 m	9m
Vegetable	3 m x 15 m	18 m
Machinery		
Storage	3 m x 30 m	24 m
Maintenance	6 m x 15 m	20 m
Barn — no heat	6 m x 15 m	24 m

* Based on the burning building so constructed to contain a fire for 45 minutes, and the adjacent structure constructed with reflective, non-combustible cladding and having no openings facing the burning building.

Security

Security can be difficult. Farms are vulnerable to theft, arson and trespassing. A clear view from the house of the farm court and gas tanks discourages prowlers, and yard lights will help keep away thieves. Strategically placed gates, that can be locked to stop vehicular access at night or when you are away, can discourage unwanted intrusions. Develop an awareness of protective measures and cooperate with the local authorities.

Space

If you plan the farmstead in zones it will help you define and lay out areas more easily. The farmstead can be divided into four concentric rings, or activity zones (Figure 3):

- Zone 1. Family living;
- Zone 2. Machinery storage and service;
- Zone 3. Grain handling and storage, and small animal buildings;
- Zone 4. Major livestock facilities.

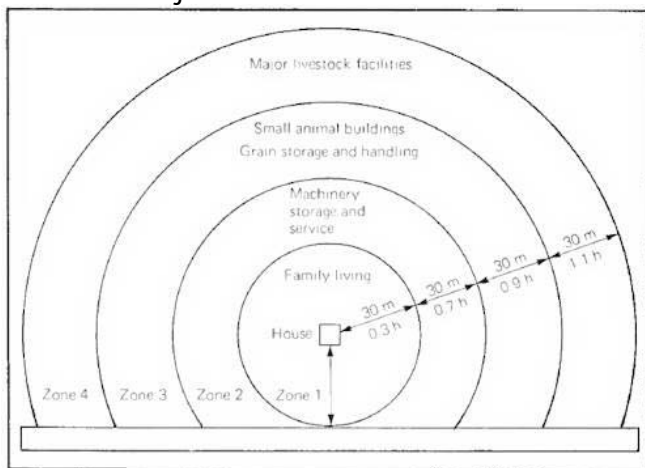


Figure 3 — Four planning zones.

The family living area includes the house, lawn, patio, play areas, garden, garage, guest parking, and a portion of the drive. Allow at least 0.28 ha for this zone. Although living at the production site may not be desirable or practical with some very large enterprises, most farmsteads do include a home for the owner-operator. This makes the farm more attractive to potential buyers.

The house is usually the office or communication headquarters for your operation. If planning a farmstead without a house, consider the farm court as the operational center; movement of vehicles, animals and materials will focus around it.

Increase labor efficiency by making the distance between the most frequently used work areas and the home or shop as short as possible. Since supervision and easy access are usually critical with young animals, have them near the farm headquarters. They can be housed in buildings easy to landscape and pleasant to view.

Each farm enterprise has unique and specific space requirements which must be met if the operation is to be carried on effectively. For example, a single-enterprise grain operation needs about 2 ha farmstead space for machinery storage and servicing, and for grain storage and handling. If, however, you add a livestock enterprise to this operation, you will need much more space for the extra buildings and facilities.

When planning a farmstead and planting shelter-belts, remember to allow extra space for future expansion or addition of new enterprises.

A neat and attractive farmstead is an important goal for many farm families. Consider placing easily-landscaped activity areas near the house and less attractive ones at a greater distance.

HOW TO PLAN ACTIVITY ZONES

Consider all the planning factors essential to each activity zone, to ensure it fulfills its function and contributes to a good overall farmstead plan.

Zone 1 — Family living

The family living zone includes the house, garage, guest parking, patio, recreation area, garden and orchard.

It should have water for drinking, washing, cooking, cleaning, landscaping and gardening. Make sure drainage is sloped away from the house and lay weeping tile around the basement. Without proper drainage, recreation space such as children's play areas and patios can turn into useless mudholes during wet seasons.

Protect living and recreation space, and flower or vegetable gardens as much as possible from noise, odor, dust and dirt with strategically located tree screens. Have family and guest parking close to the house (See Figure 4). The house should give a good view of the entrance driveway, preferably from the kitchen or dining room window. This lets whoever is at home keep his eye on the comings and goings of various people during the day. If your site offers any beautiful views, orient the house to take advantage of them.

Consider landscaping your farmstead for both beauty and function. Trees can provide shade for recreation areas and patios, and shelter them from winds.

Zone 2 — Machinery storage and service

Zone 2 can include the farm workshop, machine shed, work yard, equipment parking, fuel and chemical centers, and transformer pole.

Machinery storage and other facilities that are relatively quiet and odor-free are located in this ring.

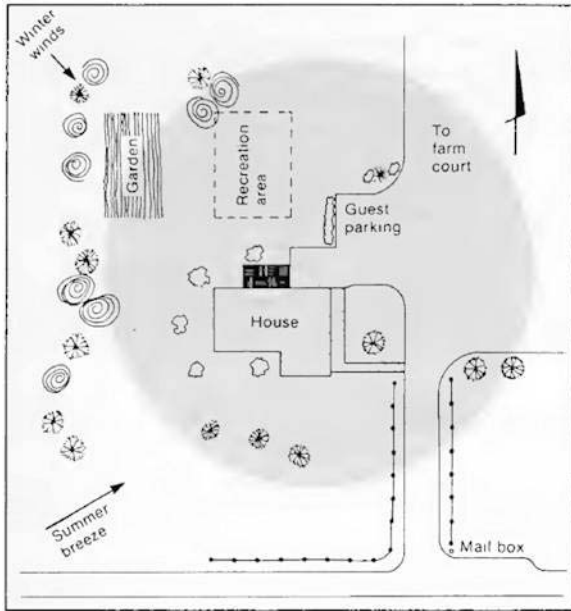


Figure 4. — Zone 1, for family living.

Much of the driveway and farm court may also be in Zone 2 (Figure 5).

A level site is best. Raise buildings, floors, parking aprons, and access lanes to improve drainage. Drainage must be away from buildings and parking areas. You will also need space for temporary parking of machinery and storing plowed snow.

Put the shop at the end of the equipment-storage building closest to the house. Pave a 12 to 15 m wide servicing area in front of the shop; a clear area to one side of the shop is also useful. Here you can give your combine its summer overhaul without tying up the space in front of the shop. You need heavy wiring for lights, power tools, and a welder. Make sure provision is made for heating.

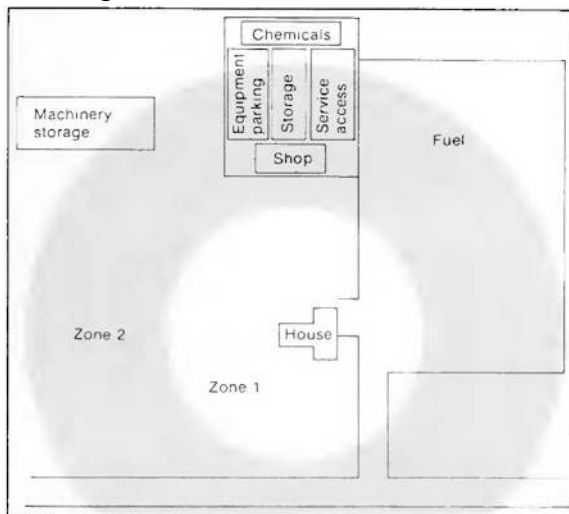


Figure 5. Zone 2 for machinery storage and service.

You also need electricity in the machine shed, for service outlets and lighting.

Build the shop storage so more storage can be added later. Machinery parked beside the storage building can be screened from view with trees and shrubs. Face machinery-storage doors away from public roads for better appearance, safety, and security.

Flammable materials are stored and used in this zone too, so provide a 30 m separation between buildings, to control fire spread. Store fuel and chemicals toward the outer perimeter of Zone 2. This leaves them near machinery but 60 m away from the house, reducing the hazard to children and providing good fire separation.

Consider separate storages for fuels, pesticides, and fertilizers since these products can contaminate one another.

You need water to mix some pesticides, so be sure waste water can be disposed away from water sources and areas where children might play.

Isolate fuel pumps from buildings for safety. Provide gravel or hard-surface access to pumps from two or three sides. Slope the ground away from the fuel center to drain rainwater and gasoline fumes away. Place a dry-chemical fire extinguisher nearby. Paint aboveground tanks white or silver, or preferably cover them with a sun shade, to reduce evaporation and deterioration of fuels.

Underground fuel storage reduces evaporation losses and improves farmyard appearance.

Zone 3 — Grain handling and storage, and small animal buildings

Zone 3 can include general-purpose and maternity barns, brooder houses, grain storage, handling and drying facilities, feed-processing equipment, and feed and fertilizer storage.

Storage and processing units for grain and feed can be dusty and noisy when operating, so put them further from the house. Daily feed-processing centers should be farther away from the house than a higher volume cash-grain center, where noises may be limited to a few weeks a year.

A four-bin grain-handling facility, with a center building and drying and storage for up to 1500 m³, requires an area 30 x 30 m plus room for heavy vehicles to approach and leave. It's best if large bulk-delivery vehicles can drive through rather than back up in a feed-grain processing operation. Be sure to include ample turning space, and avoid future congestion by allowing room for expansion.

Large grain-processing and storage centers often require high-power electric motors. Place the transformer as close as possible to a large grain center to reduce power loss in the lines to the larger motors.

Avoid overhead electric lines where high vehicles are used. See your local power suppliers for planning assistance.

Other fuels such as natural gas may be used as a power source in a grain-drying system. Request assistance from the gas company when planning such installations.

Facilities such as a brooder house, a stable for a couple of riding horses, or housing for a few small animals can also be located here. A small livestock building close to the house is convenient for active management and is acceptable if neat, attractive and downwind.

Have a water supply for the barns and perhaps for washing, dilution, and fire control.

Zone 4 — Major livestock facilities

Zone 4 can include feedlots, hog, dairy, sheep, poultry and beef facilities, forage and silage storage, pastures, and manure storage and disposal.

Major livestock facilities are furthest from the house, largely because of odors, but also because of layout requirements. A large unit, involving either confinement housing or a drylot, needs drainage, access, loading facilities, feed distribution and other services. Allow flexibility for future development and change. Remember that new enterprises may be added while present ones may be discontinued. Moving away from an old farmstead to a new one is often the most economical way to solve problems that arise from a major expansion.

Water is essential for drinking, cleaning, sanitation, spraying, waste removal, and summer cooling for animals. For optimum production livestock need adequate drinking water.

Drainage is most important. Locate your facilities on high ground — do *not* build in a hole. You can correct some problems by ditching and grading the site, but earthwork is costly and should be minimized.

Table 2 — Zones for livestock operations.

No. of animal units ¹	Farmstead zone	Minimum distance from house for nearest livestock buildings (m)
1 to 20	2 or 3	30
20 to 75	3	60
75 to 500 ²	4	90

¹ One animal unit = 450 kg animal weight
² Over 500 animal units may overwhelm other farmstead components. Consider a separate center isolated as far as practical from the residence.

Odors, dust, noise, and waste pollution are nuisances that can affect not only your farmstead but your neighbors', too. Waste management is a critical factor in any livestock operation and you must make suitable arrangements in the initial planning to avoid future problems.

Isolation distances for livestock buildings depend on the kind of animals, their age and size, the size and type of structure, and the amount of care required (Table 2).

TOPOGRAPHY

Topography, or the relief features of the land, influences drainage, access, view and how you should build facilities.

An effective farmstead must have adequate surface and subsurface drainage. Although natural drainage is best, such conditions are seldom found, and some diversion work is usually needed (Figure 6). Ideally, drainage for a livestock operation should be directed away from both the overall site and each individual area toward a catch basin.

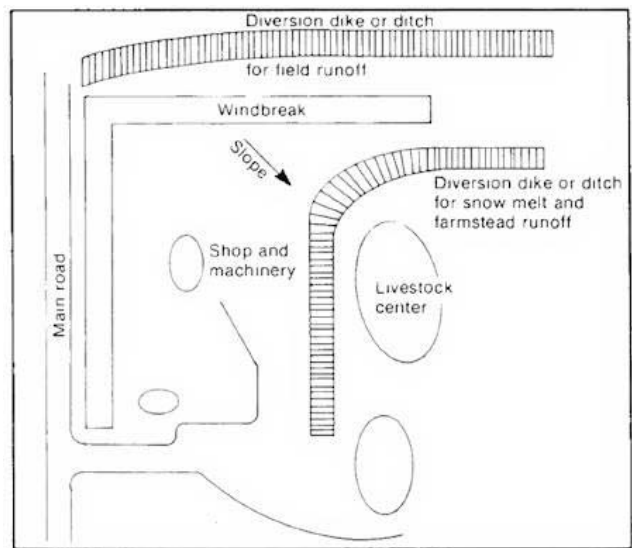


Figure 6. Water-diversion structures.

Slopes

Most slopes should be from 2 to 6%, steep enough to drain but not enough to cause excessive erosion. Feedlots must be sloped more steeply, at 4 to 8%. If your site is level, you will have to grade. Grade relatively small areas to the desired slopes before you build (Figure 7).

Subsurface drainage

Provide subsurface drainage for basements, grain elevator pits, and below-grade storages used for waste or silage. Be sure to keep drainage from waste

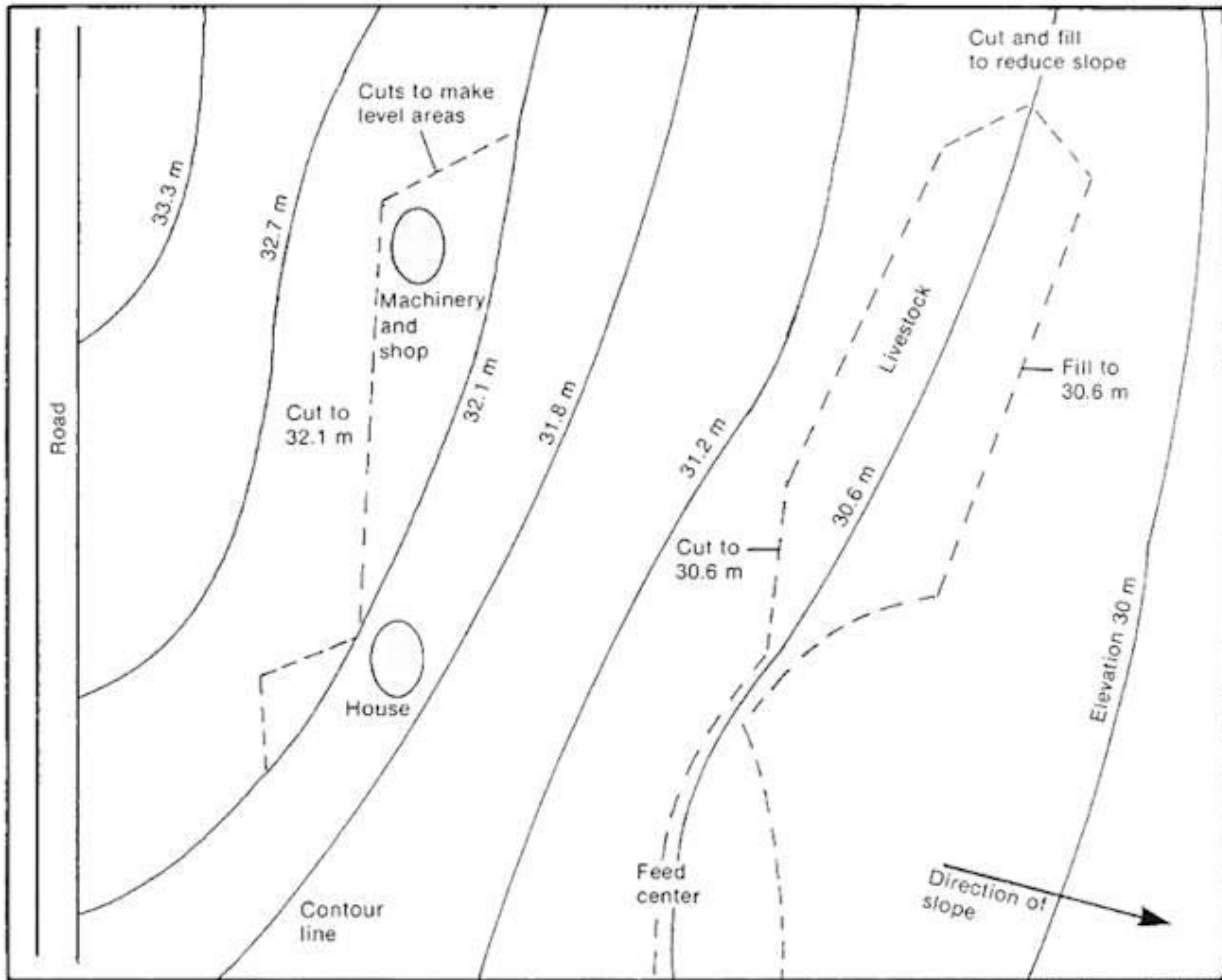


Figure 7. Contour maps help determine necessary site grading.

facilities and silos from polluting underground water sources and stream water.

SOIL

Locate your farmstead on productive soil so you will have good gardens, lawns and trees. Lush vegetation gives food, beauty, and protection from the elements.

CLIMATE

If you design and arrange farm buildings properly, you can minimize the undesirable effects of climate and take advantage of the beneficial ones.

Wind may increase both summer comfort and winter discomfort. It carries dust and odors and causes snow drifting.

Heat from the sun is useful energy in cold weather — it warms buildings and helps dry surfaces. In hot weather, livestock need protection from the direct sun. How you control heat and light

in winter and summer depends on climate and latitude (distance north of the equator). Consider the seasonal effects of sun heat and light when locating and orienting buildings and other facilities.

Wind

Determine the direction of prevailing winds and place shelterbelts to protect the farmstead from winter winds and still allow summer winds to enter for a cooling effect (Figure 8). Try to protect the house, service and cattle feeding areas. Man-made wind-control structures give additional protection; porous fences of 80% density are best. (Figures 9 and 10).

Precipitation

Precipitation causes drifting and erosion, and creates problems of drainage. If designed to handle unusually heavy snow or rain storms, your farmstead will handle lesser storms with ease.

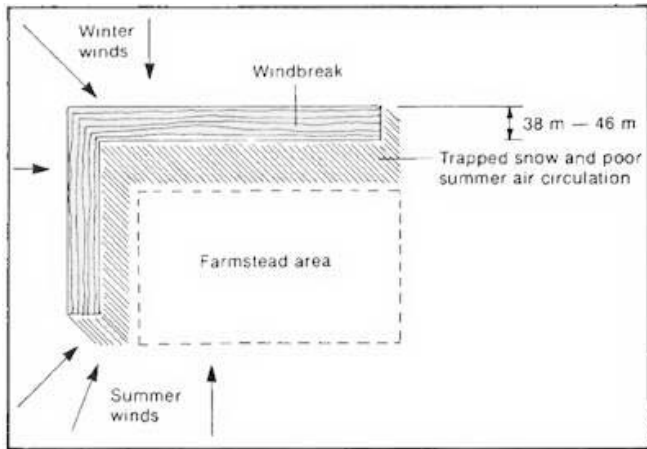


Figure 8 — Windbreak orientation.

Accumulations of snow affect farm buildings, doors, entrances and driveways. Under extreme conditions, wind and snow control is never 100% effective; however, following a few guidelines will help you reduce problems. Figures 8 through 12 illustrate the effects of windbreaks on snow and wind movement. A porous fence reduces wind velocity for a greater distance (Figure 10). The snow accumulation for a solid fence and fences of different porosity are shown in Figure 12. Figure 11 shows how to locate fences around an open-front shed.

You can use diversion terraces, grassed

waterways and drainage systems to collect and divert run-off from rain and melting snow. Minimize run-off handled by the livestock waste-disposal system. Use roof gutters and diversion ditches to direct clean water away from lots.

Sun

All buildings are, in effect, heat traps since they accumulate heat from the sun, lights and livestock. In summer, the best way to keep temperature comfortable inside a building is to control heat from the sun.

Farm buildings can be designed and oriented to exclude sun during hot summer months and let it enter during the winter. You can build ways of sheltering the buildings from the sun into the structure and surrounding area. Without sun shields, exterior roof surfaces may reach 60°C, even when actual air temperature is below 35°C.

Roof overhangs are particularly effective for southern exposures. For latitude 50°N, the width of roof overhang (or horizontal shade projections over windows) should equal the height of shadow required to cover the window or opening. East and west exposures are difficult to shade with overhangs because of the low angle of the sun (Figures 13 and 14).

Awnings and louvers are 65 to 75% effective in reducing heat on east, south and west exposures.

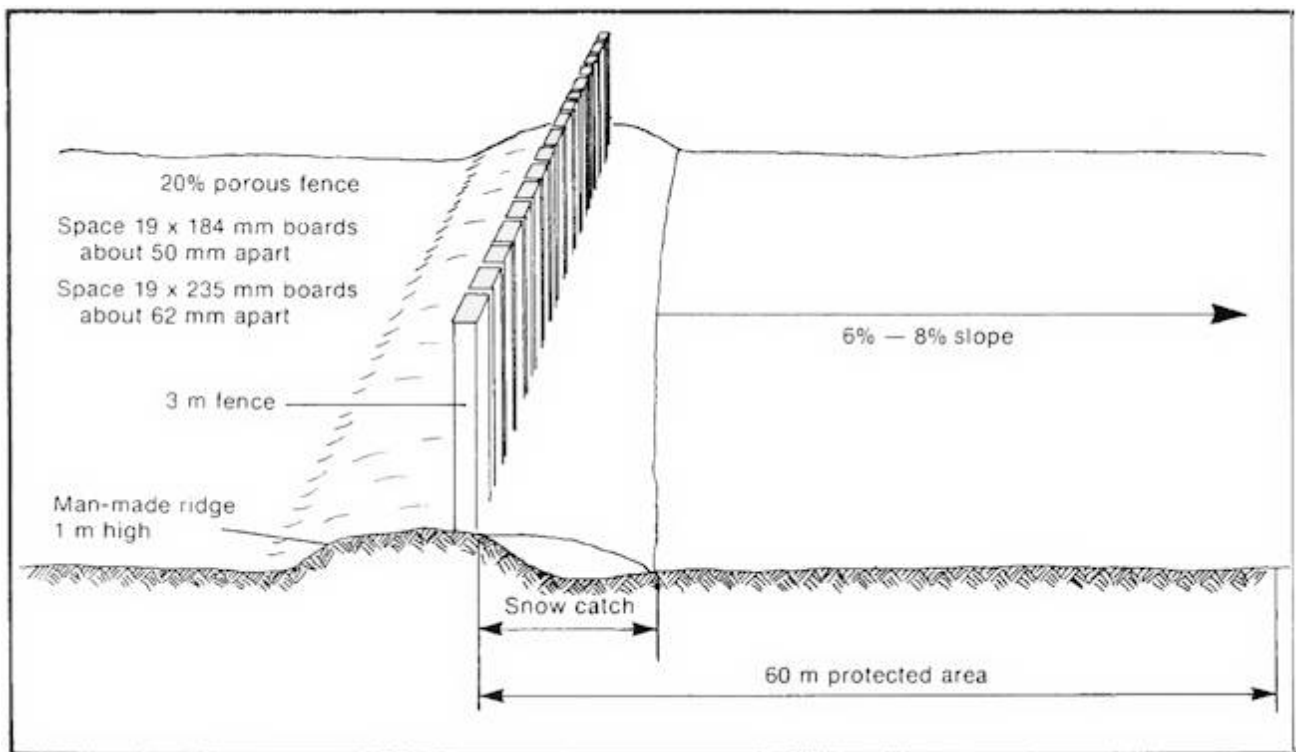


Figure 9. Windbreak on a ridge increases the protected area.

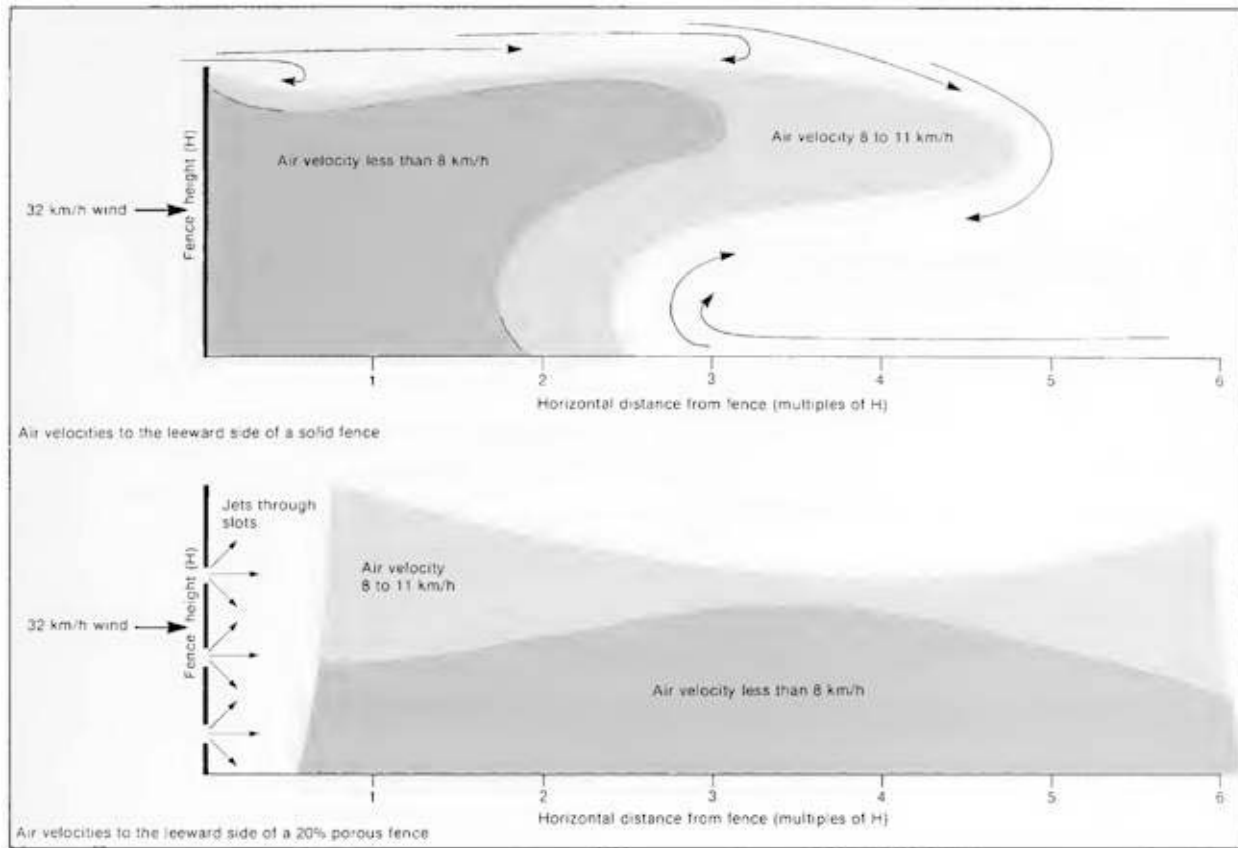


Figure 10. Effect of fence porosity on air velocities.

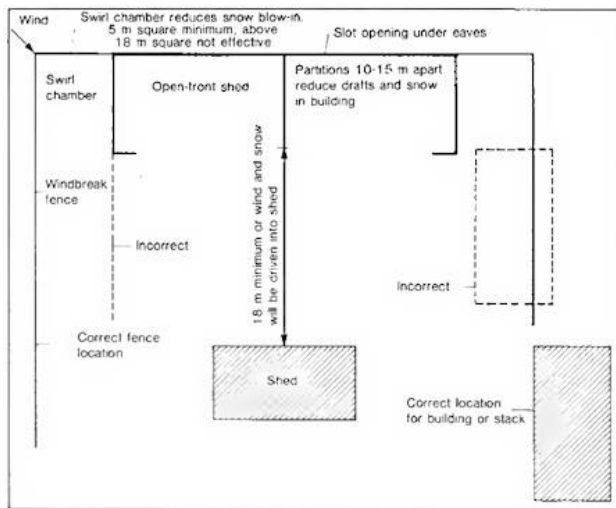


Figure 11. Snow and wind control for an open-front shed.

Trees are best for shading east and west exposures. Use deciduous trees because they lose their leaves in fall and allow the sun to penetrate in winter (Figure 15). Evergreen trees shade the year round.

Use light colors on exterior walls and roofs to

reflect sun rays and reduce the heat load; dark colors absorb heat.

Face open structures such as beef sheds south to take advantage of the sun's heat as well as its drying and sanitizing capabilities (Figure 16). Large openings in building walls let sunlight enter the building, but inside areas toward the back and outside to the north will not thaw or dry rapidly because they are shaded during the warmer time of day.

INCREASING SIZE

If you expand your operation you need more space, but there are other things to consider as well. For instance, doubling the number of animals in a livestock operation does more than just double the space needed for animals. It affects feed processing and storage requirements, machinery inventory, vehicular traffic, water and electrical supply, and drainage systems. You must realize the impact this has on the farmstead; nuisances such as noise, dust, chaff, odors, flies, and heavy traffic increase. Buffer the house by placing operations producing these nuisances well away and downwind. Proper management will minimize the problems. In some cases it may be better to separate the farmstead into two separate sites.

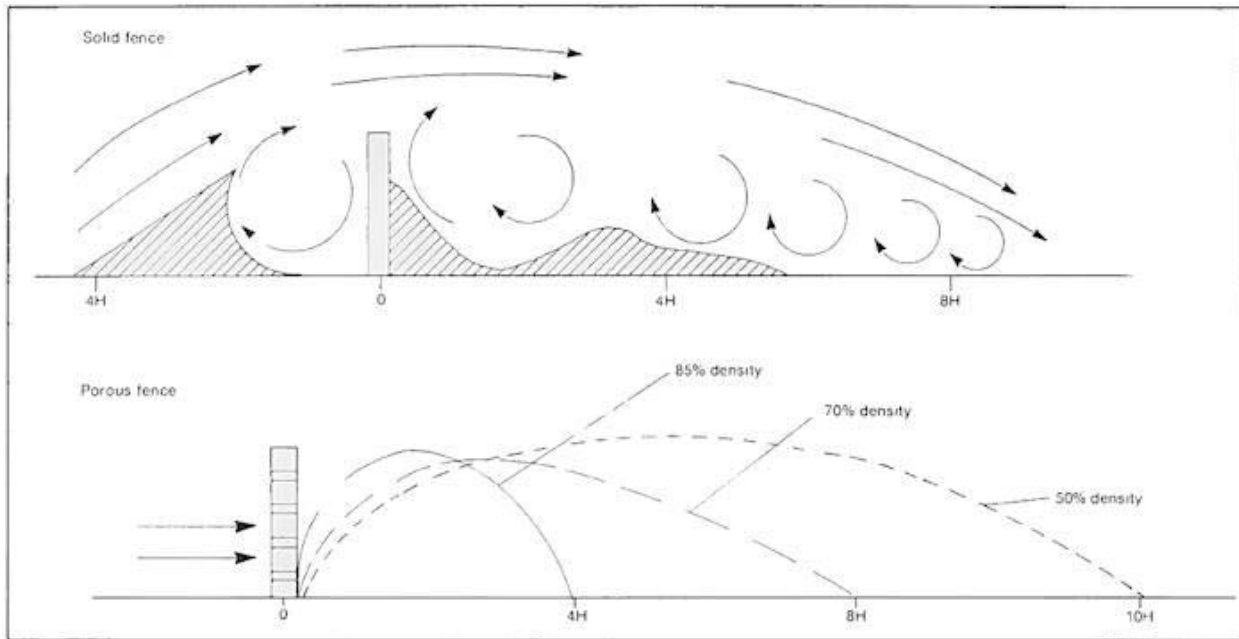


Figure 12. Snow accumulation for solid and porous fences.

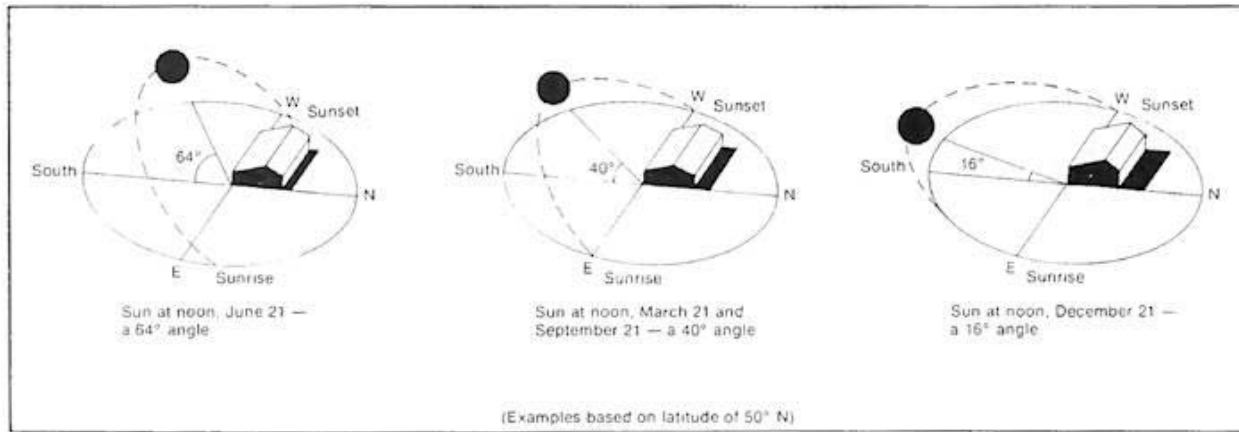


Figure 13. Sun angles.

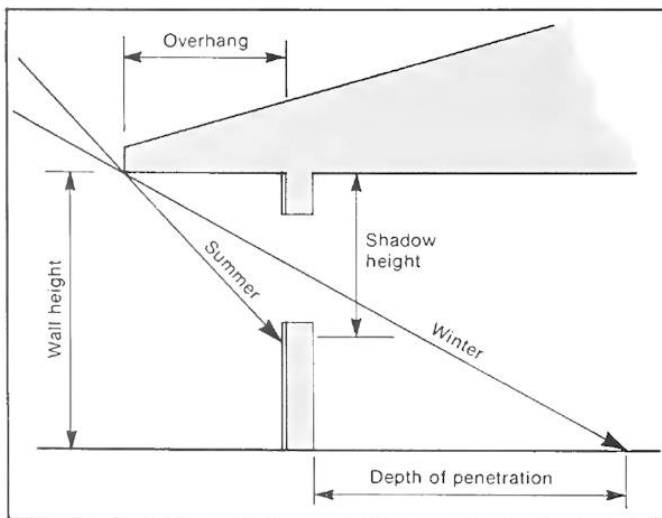


Figure 14. Sun angle, winter and summer, showing the effect of a building overhang.

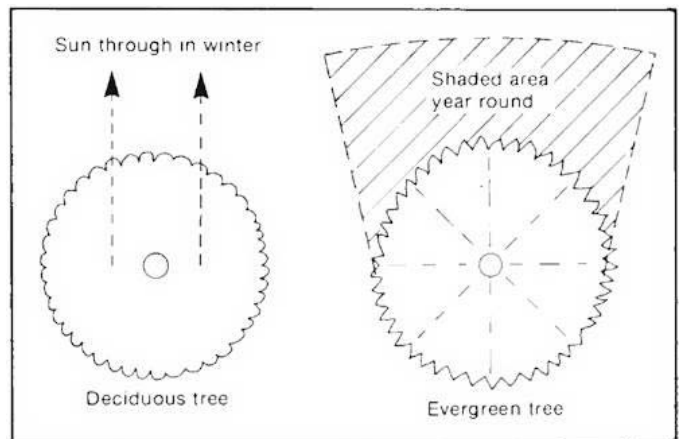


Figure 15. Shade of deciduous and evergreen trees compared.

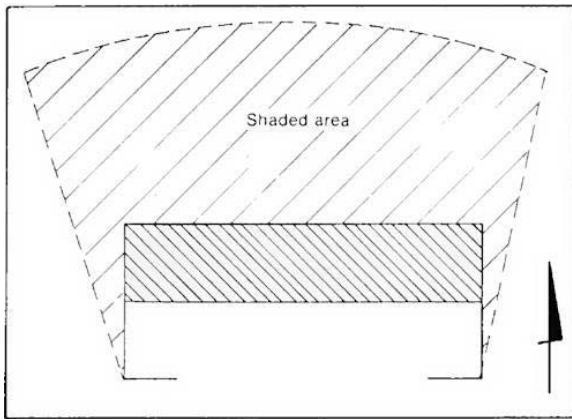


Figure 16. Shadows north and inside of buildings.
OFF-FARM FACTORS

The location of the farmstead in relation to a town, service center, highways and neighbors is important. The closer to town and service centers, the less time it will take you to travel to schools and stores. Building right next to a highway ensures good road access but increases traffic noise problems, and if your farmstead is too close to a busy gravel road, dust can be a problem.

Your personal preferences play the deciding role in considering off-farm factors. It is necessary to compromise between privacy and convenience. You may find it difficult to have privacy and still keep easy access to highways, towns and service centers.

STEPS IN PREPARING A PLAN

Prepare site plan

Prepare at least one scaled map of your site using graph paper. It is best to draw a large-scale map with room for considerable detail. Try a scale of 1:200.

An aerial photograph is useful; your municipal and county offices may be able to provide one. Use it to position your buildings and drives.

Another way to prepare the plan is to first lay out a grid system of 10 m squares over your entire farmstead site. Place a stake at each corner of the squares, and label it with a number and a letter to show its position. Then, make a grid on graph paper, and draw in all drives, buildings, water, power, or other facilities. For example, a barn has its southwest corner at 60+9E and 100+7N (Figure 17). For each building, note the positions of windows and doors.

Evaluate existing buildings

Evaluate any existing buildings as they are now, and as they might be after remodelling. Consider their position, value to the farm business, appearance, state of repair, and suitability for

intended operations. Is an old barn worth remodelling or should it be replaced? In some cases remodelling costs more than a new building and still provides less than an ideal facility. Talk to builders and supply companies to help evaluate costs of proposed changes.

Establish your needs and goals

After studying what you've got now, and some of the things you might do, define *why* you are planning. Write down reasons and refer back to them later. You may decide that a drainage problem is really a symptom of a greater problem, such as a poor site.

Define your goals. You may want a more efficient way to move equipment. You may feel the need to avoid pollution. Or you might really be looking for a better place to live.

Laws and regulations may affect you. Look into zoning, development, and environmental protection laws.

Above all, consider yourself and your family — what you like to do and how well you can do it. To work, the plan must be your own and be designed to accomplish your objectives.

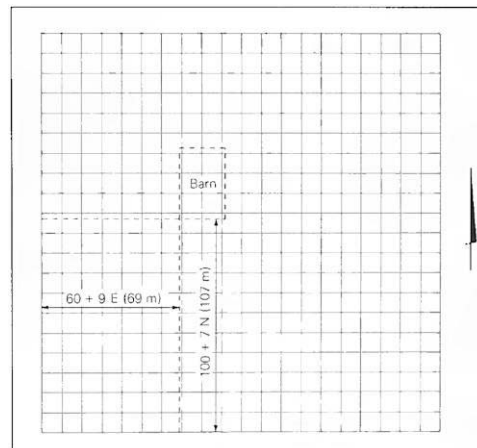


Figure 17. Grid layout for a farmstead map.

Locate your activities

Tape a sheet of tracing or tissue paper over the drawing of your present farmstead. Using the house as center, draw in concentric circles 30 m apart for the four activity zones.

Then, locate the proposed activities within the zones. Show the activities as circles or ovals, not as drawings of buildings and lots. Add circles for fuel and a traffic hub or farm court.

Parts of some livestock enterprises create much less nuisance than others. A milkhouse or an egg-sorting and cooling room have little effect on the family living zone except for visits by an occasional truck. Therefore, you could place these units on the end or side of a barn closest to the house (Figure 18).

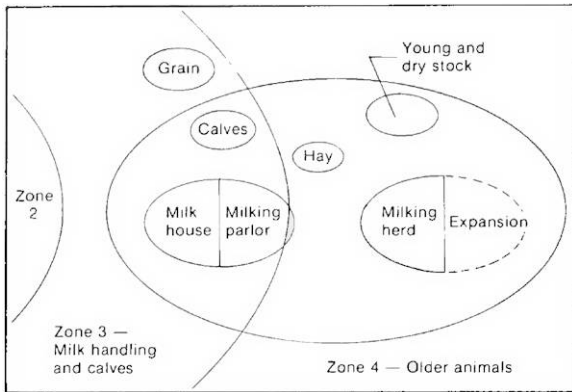


Figure 18. Zone planning of a dairy center.

Disregard the existing buildings on your farmstead map. This may seem foolish, but the first objective is to find the best plan as if nothing were in the way. Any other plan will be no more than a good compromise. By going for the best, you may discover a major improvement can be made by remodelling or moving some relatively minor building or road.

Try alternate layouts

Consider alternatives by taping other tracing sheets over the plan, changing the boundary and rearranging use areas. Compare the various layouts by how well each solves the critical factors, and how much the improvements would cost over the years.

Lightly sketch in buildings, well, septic tank, power poles, and trees as your plan becomes more complete. Don't put in roads until your building locations are determined. Remember, roads are determined by building service and flow needs, not vice versa.

As your goals, and how to reach them, begin to take final form, make cutouts of major facilities. It is easy to shift a proposed postage-stamp-size barn as you compare layouts for factors that affect other centers and daily chore routes.

Develop the map of your farmstead further by making an overlay tracing sheet to show utilities. Draw in the path of each overhead and buried cable. Include electric, gas, telephone, and water lines, septic tanks, drainage fields, and drain lines. Use colored pencils or pens, and dashed, dotted and solid lines to identify each utility.

Draw in contour lines

If your site has been surveyed for elevation, lightly draw in the contour lines to help determine drainage (Figure 19). Indicate steep and gentle slopes. Also, draw the land area around buildings, for example, the machine shop, that should be level. Indicate where slopes are needed for drainage.

Finish your plan

Draw up the final farmstead layout you want to work towards. Show buildings, roads, level areas, sloped areas and shelterbelts (Figure 19). Use symbols where possible to reduce the amount of labelling.

A well planned, beautiful farmstead is an asset not only to you by increasing your farming efficiency, but is something that can bring pride to an entire community. Remember, it must be planned so it can change and grow with the farming operation.

Planning your farmstead is not an impossible task. Do not hesitate to ask your agriculturalist for help; he can also direct you to other sources when you need more detailed information.

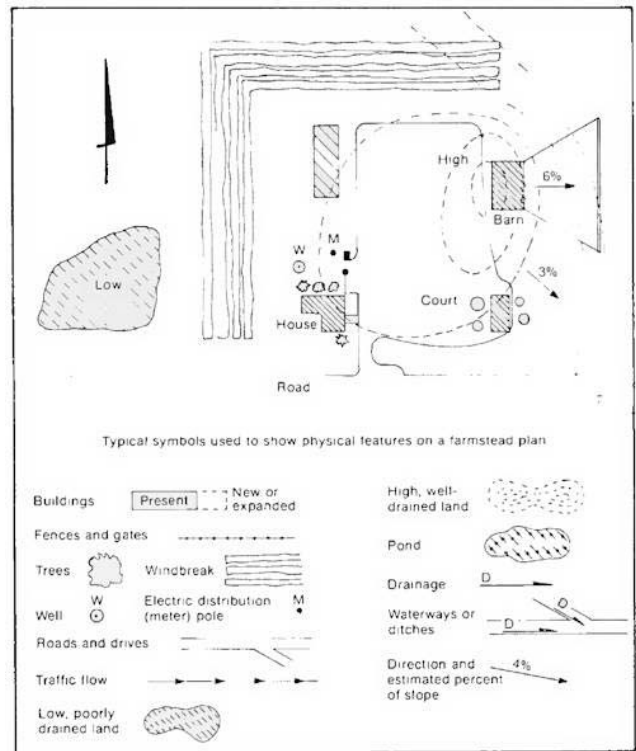


Figure 19. Drawing your farmstead map.

FARMSTEAD AND LIVESTOCK SHELTERBELTS

A farmstead shelterbelt is a series of rows of trees and shrubs planted to provide protection and to beautify. Trees moderate the effect of harsh winds and create an enjoyable environment in which to live and work. As all farmsteads differ in size, location and topography, you must consider many aspects of shelterbelt design.

Benefits of shelterbelts

One of the most important effects of multi-row shelterbelts is a reduction in heating costs for livestock-production facilities and farm homes. Rising

fuel prices are making building-heating costs a major part of production expenses for hogs and poultry. As shelterbelts lower wind velocity, less heat is lost from buildings, reducing the entire heating bill.

Studies show that the rate of feed conversion may improve if beef animals are sheltered. Shelterbelts tend to stabilize wind velocity, reducing temperature fluctuations due to changes in wind speed. This promotes better livestock conditions by reducing climatic stress on exposed animals.

Snow drifting into farmstead and feedlot areas causes considerable nuisance and expense to remove, but can be virtually eliminated with well-planned shelterbelts. These belts give greater protection than porous fencing. In addition, farmstead shelter helps protect buildings and machinery from weathering due to windblown snow, soil and rain. Take care, however, to ensure enough space is left between buildings and trees so snow will not drift into the building area (Figure 20).

Table 3. Benefits of shelterbelts.

1. Reduces heating costs	1. Reduces heating costs for heated facilities
2. Reduces snow-removal costs	2. Encourages better animal performance
3. Adds aesthetic value	3. Reduces stress on animals
4. Reduces weathering on buildings	4. Reduces snow build-up in pens
5. Modifies microclimate to promote growth of farmyard horticulture	
6. Reduces noise from adjacent grid roads	

With the harsh Canadian winters, ornamental, fruit and vegetable plants require additional care and protection to let them grow and bear fruit. Trees moderate the effects of severe wind and reduce

desiccation of buds on deciduous trees and winter browning on ornamental evergreens.

Farmstead shelterbelts generally provide a more comfortable environment for work and relaxation. They reduce noises entering the farmstead from highways and municipal roads and increase the attractiveness of the building area, often resulting in a higher assessed value of the farm.

Planning shelterbelts

Good planning is essential in developing effective farmstead and livestock shelterbelts; the principles of design are similar for both types. Basically, the typical belt is a series of three to five rows of trees on the perimeter of the farmstead. Shorter-growing species should be on the outside to direct the wind up over the shelterbelt (Figure 21). The second row consists of fast-growing deciduous trees of intermediate height. As faster-growing trees are usually shorter lived, allow enough space to permit easy removal should the trees die (particularly true of poplar and Siberian elm). The third row should be of long-lived deciduous trees. Finally, two rows of long-lived tall-growing conifers are planted on the inside. Conifers require protection by the outer rows to promote good growth and survival, but once established, their protection and beauty exceed that of all other species. Table 4 gives suggested species for all five rows.

Do not extend five-row belts around the entire farmstead. The resulting wind reduction would increase summer temperatures within the building area and allow the air to stagnate. Also, livestock-production facilities within the farmstead can be an odor problem unless there is adequate ventilation.

Figure 22 illustrates typical arrangements for farmstead shelterbelts. Note the two methods of providing field access: at the left, the access is staggered

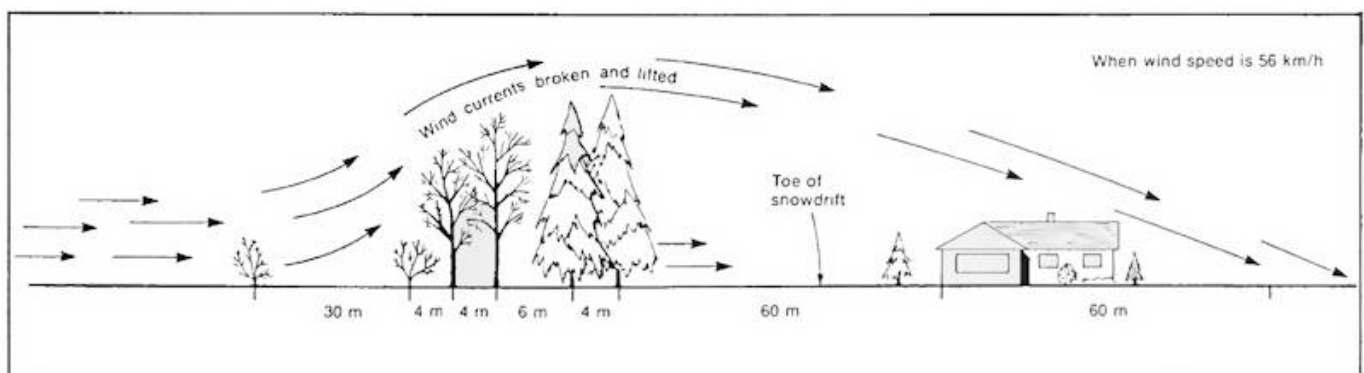


Figure 20. Typical farmstead shelterbelt design.

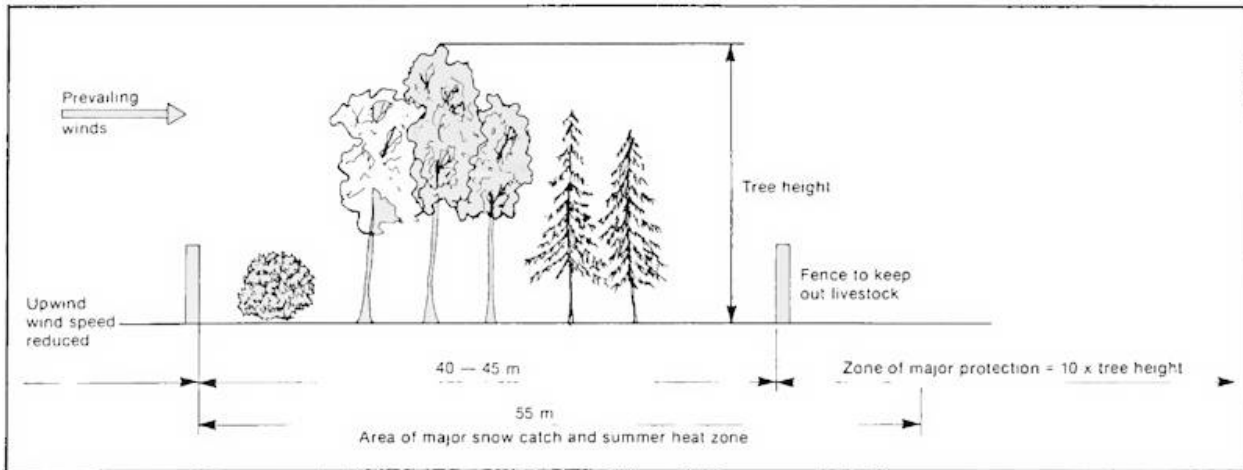


Figure 21. Protect the tame living zone with a shelterbelt.

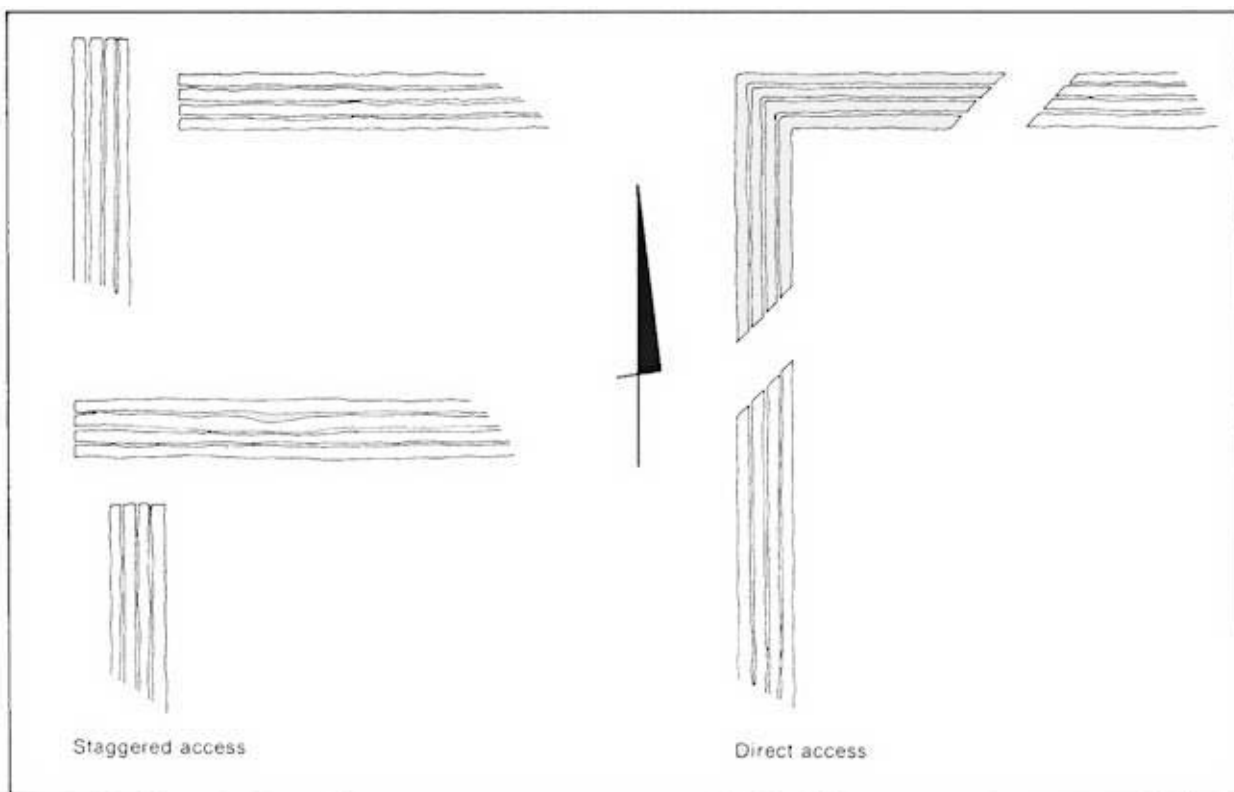


Figure 22. Typical arrangements for accesses in farmstead shelterbelts.

so the wind cannot gain a direct passage into the farmyard; at the right, the access lets the wind blow into the farmyard but not directly onto the buildings. If the farmstead is large, you may have to plant additional single-row belts within the farmstead itself to ensure maximum wind reduction.

Spacing, both between trees and between rows, is extremely important. Trees planted too close are

often short-lived as a result of competition. In general, allow a minimum of 4 m between any adjacent tree rows to trap heavy snow drifting over the other rows and to keep it from settling on the branches of the evergreens. In addition, a snow-trap row of low shrubs may be planted 25 to 30 m from the main shelterbelt to prevent drifting into the building area, even during the most severe blizzards.

Table 4. Species' for use in farmstead shelterbelts.

Small deciduous	Medium deciduous	Tall deciduous	Tall coniferous
Poplar	Siberian elm	Green ash	Colorado spruce
Caragana	Willow	American elm	White spruce
Buffaloberry	Poplar	Manitoba maple	Scots pine
Amur maple	Chokecherry		
Villosa lilac			
Honeysuckle			

¹ Check with the department of agriculture in your province to determine suitable alternative species.

Many farmers like to prune their trees from the bottom to allow ease of cultivation. Pruning should not be done, however, because a wind tunnel effect may be created. Protection must extend at all levels from the bottom to the top of the shelterbelt.

With livestock shelterbelts, ensure that effluent from feedlots does not drain directly into the trees, because over a period of years build-up of salts may destroy them. In addition, fence shelterbelts to prevent livestock from damaging the trees by eating, trampling, or breaking branches.

Farmstead shelterbelts compete for moisture with adjacent gardens and lawns. Do not plant species with strong lateral roots, such as poplar

and Siberian elm, adjacent to gardens. The competition by the trees will reduce the yield of the garden crops.

ACKNOWLEDGMENT

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CONVERSION FACTORS

Metric units	Approximate conversion factors	Results in:
LINEAR		
millimetre (mm)	x 0.04	inch
centimetre (cm)	x 0.39	inch
metre (m)	x 3.28	feet
kilometre (km)	x 0.62	mile
AREA		
square centimetre (cm ²)	x 0.15	square inch
square metre (m ²)	x 1.2	square yard
square kilometre (km ²)	x 0.39	square mile
hectare (ha)	x 2.5	acres
VOLUME		
cubic centimetre (cm ³)	x 0.06	cubic inch
cubic metre (m ³)	x 35.31	cubic feet
	x 1.31	cubic yard
CAPACITY		
litre (L)	x0.035	cubic feet
hectolitre (hL)	x 22	gallons
	x 2.5	bushels
WEIGHT		
gram (g)	x 0.04	oz avdp
kilogram (kg)	x 2.2	lb avdp
tonne (t)	x 1.1	short ton
AGRICULTURAL		
litres per hectare (L/ha)	x 0.089	gallons per acre
	x 0.357	quarts per acre
	x 0.71	pints per acre
millilitres per hectare(mL/ha)	x 0.014	fl. oz per acre
tonnes per hectare (t/ha)	x 0.45	tons per acre
kilograms per hectare (kg/ha)	x 0.89	lb per acre
grams per hectare (g/ha)	x 0.014	oz avdp per acre
plants per hectare (plants/ha)	x 0.405	plants per acre