Riparian
FACTSHEET

BRITISH COLUMBIA | Ministry of Agriculture

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GEOSYNTHETIC MATERIALS
What Are They? How Are They Used?

This Factsheet gives a general description of geosynthetics and identifies various types that are available for specific purposes. Reference is made to two Factsheets for more specific information and case examples.

What Are Geosynthetics?

Geosynthetics are man-made materials used to improve soil conditions. The word is derived from: ***Geo*** = earth or soil + ***Synthetics*** = man-made

Geosynthetics are typically made from petrochemical-based polymers ("plastics") that are biologically inert and will not decompose from bacterial or fungal action. While most are essentially chemical inert, some may be damaged by petrochemicals and most have some degree of susceptibility to ultraviolet light (sunlight).

Geosynthetic materials are placed on or in soil to do one of four things (some may perform more than one of these functions simultaneously):

- **separation/confinement/distribute loads** (refer to Figure 3, page 3)
  - improve level-grade soil situations such as roads, alleys, lane ways
  - improve sloped-grade situations such as banks, hillsides, stream access points
- **reinforce soil**
  - soil walls, bridge abutments, box culverts/bridges, and soil arches
- **prevent soil movement** (piping) while letting water move through the material
  - such as in drainage systems and back fill around water intakes
- **controlling water pressure** allowing flow (drainage) in the plane of the material
  - such as on foundation walls to allow water to move down to perimeter drains

There are a number of different geosynthetic materials, and with the similarity of many of the names, as well as many similar sounding trade names, it can be confusing without an understanding of the basic categories. For the types typically used in agricultural applications, they fall into these categories:

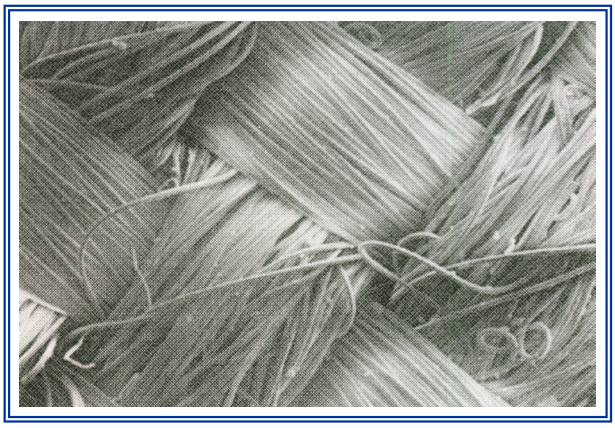
- **geotextiles**, used for drainage, separation and reinforcement, are in two forms
  - **woven** - cloth-like materials with fibers woven perpendicular to each other
  - **non-woven** - felt-like materials with randomly-oriented fibers
- **geogrids** are open mesh-like materials used for stabilization and reinforcement
- **geocells** are cavity-like materials in a web used for stabilization
- **geomembranes** are very low permeability liner or fluid containment materials
- **erosion control** materials that are biodegradable or non-biodegradable

Geotextiles

Geotextiles are defined as "*any permeable textile used with foundation soil, rock, earth, or any other geotechnical engineering-related material as an integral part of a human-made project, structure, or system*". They are typically the most used geosynthetic material for agriculture purposes.

These are fabric or cloth-like materials that are classified based on the method used to place the threads or yarns in the fabric: either woven or non-woven. Geotextiles typically come in rolls up to approximately 5.6m (18 ft) wide and 50 to 150m (160 to 500 ft) long.

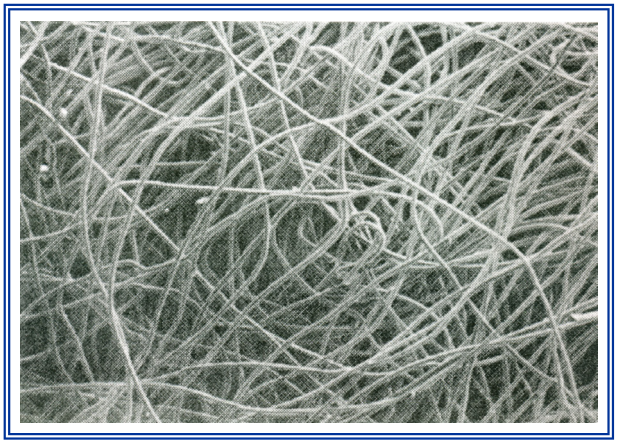
Woven. These cloth-like fabrics are formed by the uniform and regular interweaving of threads or yarns in two directions as shown in Figure 1, below. These products have a regular visible construction pattern, and where present, have distinct and measurable openings. Woven geotextiles are typically used for soil separation, reinforcement, load distribution, filtration, and drainage. They can have high tensile strength and relative low strain or limited elongation under load (typically up to 15%).



Source: Nilex Inc.

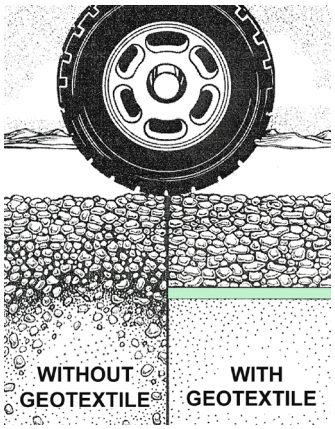
Figure 1 A Typical Woven Geotextile (Enlarged View)

Non-Woven. These felt-like fabrics are formed by a random placement of threads in a mat and bonded by heat-bonding, resin-bonding or needle punching, as shown in Figure 2, below. These products do not have any visible thread pattern. Non-woven geotextiles are typically used for soil separation, stabilization, load distribution, and drainage but not for soil reinforcement such as in retaining walls. They have a relatively high strain and stretch considerably under load (about 50%).

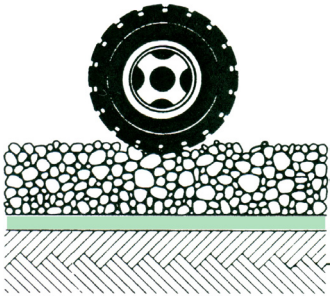


Source: Nilex Inc.

Figure 2 A Typical Non-Woven Geotextile (Enlarged View)

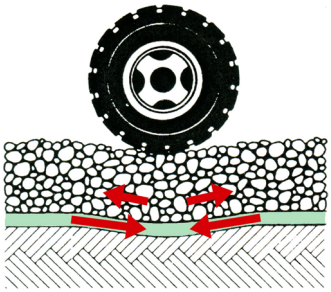


With and Without a Geotextile



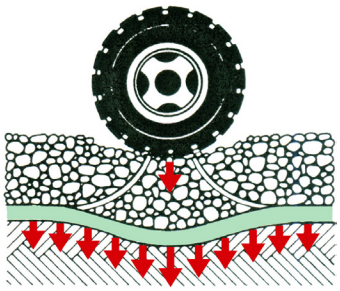
Geotextiles act as a separation barrier between fine grain soils and load-distributing aggregate fill

Separation



Geotextiles provide a high friction surface between the subgrade and the aggregate helping keep the aggregate in place.

Confinement



Geotextiles, with their high tensile strength and modulus, act to reduce localized stress by redistributing traffic loads over a wider area of subgrade

Load Distribution

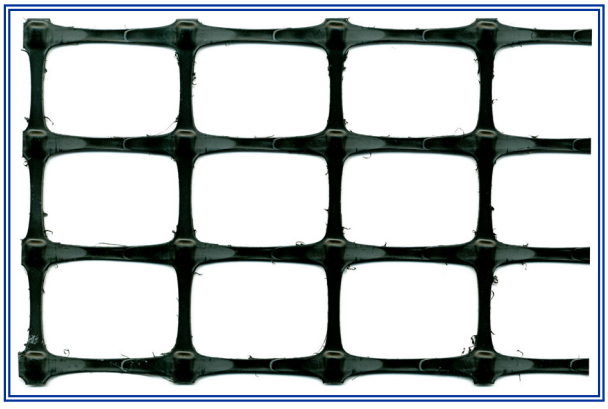
Figure 3 The Main Geotextile Characteristics

Source: Dominion Textile Inc.

Geogrids

These are open grid-like materials of integrally connected polymers, as shown in Figure 4, below. They are used primarily for soil reinforcement. Their strength can be greater than the more common geotextiles. Geogrids have a low strain and stretch only about 2 to 5% under load. Where practicable they would likely be used in heavy load or high demand agricultural situations.

A project outlined in Factsheet 590.302-2, ***Improved Livestock Access to Water Using Geosynthetics and Gravel*** used a geogrid product in a livestock access to a lake. Note that this project would now be considered "over kill" – it has since been demonstrated that a lower cost geotextile is an effective alternative material in place of the geogrid in such low load situations - refer to Factsheet 644.000-2, ***Using Geosynthetics in Building Roads, Alleyways, Stream Accesses***.



Source: Tensar Inc.

Figure 4 A Typical Geogrid

Geocells

Whereas geotextiles and geogrids are 'flat' materials, geocells or geowebs have 'depth', as shown in Figure 5, below. They are typically formed from polyethylene sheets and expand out like an accordion when opened up to use. They are meant to contain soil, gravel or other fill material within their maze of cells or pockets and may be porous to allow water movement. They are used on slopes with soft subgrades and in erosion control in channels. They may be used over top of a geotextile or geogrid. While they come in compact bundles when collapsed, they typically cover an area 2.5m (8 ft) wide by 6 to 12m (20 to 40 ft) long when expanded. Refer to Factsheet 644.000-2, ***Using Geosynthetics in Building Roads, Alleyways, Stream Accesses*** for an illustrated example of their use.

Source: Presto Products Co.

Figure 5 A Typical Geocell

Geomembranes

Whereas geotextiles, geogrids and geocells are usually porous to allow water to filter through them, geomembranes are polymer sheets used to control fluid movement. These materials have very low permeability and would be used for lining ponds, pits etc to control leachate. They may be used over top of a geotextile.

Erosion Control

Various geosynthetic materials such as tubes, mats, etc are used for erosion control. Unlike other geosynthetics, these materials may be biodegradable and may include straw and coconut matting.

NOTE: This factsheet deals with ***geo***synthetics (materials meant to be used in soil); many other similar synthetic mesh or grid products are available for uses other than in the soil such as, plastic grid fencing, shade cloth, bird netting, etc.

FOR FURTHER INFORMATION CONTACT
Phone: 604.556.3001
Toll Free: 1.888.221.7141

MINISTRY OF AGRICULTURE
1767 Angus Campbell Road
Abbotsford, B.C. V3G 2M3