

FACT SHEET
Tree Applications
树木应用



Acid Rain and Trees 酸雨与树木

Since the focus on acid rain, scientists have been concerned that acids could deplete essential nutrients. Research starting in the 1980's has attempted to understand the effects of acid rain, particularly regions that have little buffering capability, (i.e. soils formed from parent material containing little calcium). A report, *Soil-Calcium Depletion Linked to Acid Rain and Forest Growth in the Eastern United States*, USGS, published in February 1999 explains the mechanisms set in motion with acid deposition, resulting in forest losses on the Precambrian Shield, Eastern Canada and United States.

Low pH in the A horizon of soils is caused by organic acids produced by the natural decomposition of organic matter. The organic acids percolate down into the mineral layers, which contain little organic matter. In the mineral layer the organic acids are broken down or absorbed onto mineral surfaces very quickly. Unlike these organic acids sulfuric and nitric acids found in rain water and those produced by chemical fertilizers do not break down and tend to stay in solution in the mineral horizons where weathering processes are accelerated. This results in the loss of calcium and the weathering of clay minerals mobilizing aluminum and other metals to toxic levels. After silica, aluminum is the most abundant element in soils.

自从关注酸雨以来，科学家们一直担心酸会消耗必需的营养素。从80年代开始，人们就试图研究了解酸雨的影响，特别是那些没有缓冲能力的区域，即由钙含量低的母质形成的土壤。美国地质调查局于1999年2月发表了一份报告：“美国东部的土壤钙耗竭与酸雨和森林生长有关”。此报告阐释了酸雨沉积的机制，致使前寒武纪地盾、加拿大东部以及美国的森林损失。

表层土壤中的低pH值是由有机物自然分解产生的有机酸引起的。有机酸渗透到含有极少量的有机物矿物层。在矿物层中，有机酸很快分解或吸附到矿物表面上。与这些有机酸不同的是，在雨水和化肥中发现的硫酸和硝酸不会分解，而是停留在风化过程不断加速的矿物层溶液中。这导致钙的流失和粘土矿物的风化，促使铝和其他金属中毒。除硅以外、铝是土壤中最丰富的元素。

The breakdown of clay minerals also results in excessive leaching due to the loss of exchange sites in the B-horizon. The increased concentration of exchangeable aluminum is taken up by roots and eventually is recycled unto the forest floors. Dissolved aluminum can also be transported to the forest floor by a rising water table. Aluminum, having a greater affinity for negatively charged colloid surfaces further displaces calcium, resulting in aluminum toxicity.

Acid rain unquestionably accelerates the weathering process and in the absence of calcium causes the release of aluminum. Adequate calcium maintains the base cation exchange relationship. Additionally, this acidity may also increase the solubility of B, Mn, Cu, Cd, As and Ni to toxic concentrations. Phosphorous is

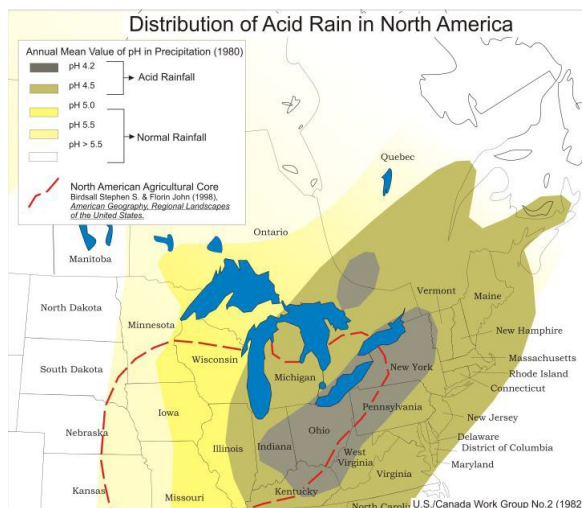
converted to insoluble Fe and Al compounds in aluminum saturated soil solutions.

Boreal has long advocated the use of Spanish River Carbonatite (“SRC”) in Eastern Ontario forestry and maple syrup production regions to combat the recognized effect of acid rain on poorly buffered soils. This problem has been highlighted in several scientific journals and papers outlining the causes of tree deaths in the region. Though in recent years the causes of acid rain have been mitigated, progressive acidification has commenced and will only be eliminated with the addition of calcium carbonate. As well as calcium carbonate SRC also contains appreciable amounts of magnesium, phosphorous, potassium, trace elements and catalytic clays to aid in improving soils lost exchange capacity.

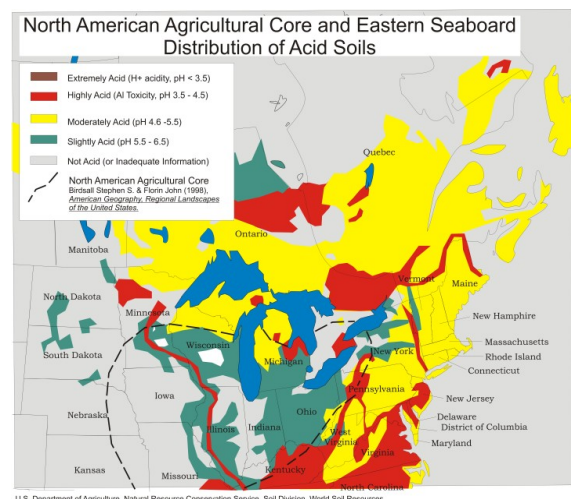
粘土矿物的分解也导致了在淀积层交换损失因而过度浸出。交换性铝浓度的增加由根部吸收，最终被回收到森林表面。溶解的铝也可以通过上升的水位被输送到森林地面。铝对负电荷的胶体表面具有更大的亲和力，进一步置换钙，从而导致铝的毒性。

酸雨无疑加速了风化进程，且在没有钙的情况下，铝会被释放。充足的钙保持基阳离子交换关系。此外，这种酸度也可能增加硼，锰，铜，镉，砷和镍的毒性浓度的溶解度。磷在铝饱和土壤溶液中转化为难溶的铁铝化合物。

在安大略东部的林枫糖浆生产地区，博莱一直提倡使用西班牙河碳酸盐岩（“SRC”）来对抗酸雨在缓冲不良的土壤中造成的显著影响。这一问题在几份科学期刊和论文中得以突出说明，概括了该地区树木死亡的原因。虽然近年来酸雨的形成已得到缓解，但逐步酸化的进程已然开始，只有在添加碳酸钙后才能被消除。此外，碳酸钙还含有可观量的镁、磷、钾、微量元素和催化粘土，有助于改善土壤交换能力损失。



北美酸雨分布



北美农业核心及东海岸酸性土壤分布

Tree Growth and Nutrition 树木生长与营养

Boreal first came across the work of Amy Trubek from the University of Vermont in the New York Times, “Fresh from Vermont’s Maples, a Taste of Terroir”. Dr. Trubek was part of a team that was looking to see if there was a connection between maple syrup and the underlying bedrock. The tests concluded that trees on limestone bedrock had the highest quantities of copper, magnesium, calcium and silica which they believed had a role in taste. Trees on shale bedrock came second followed by schist. Not only did her research indicate a change in flavor based on changes in soil parent material but significant changes in mineral content resulting in nutritional increases.

Boreal has many clients that use SRC in their orchards and vineyards to duplicate Amy Trubek’s research; that is, increased mineral content. Application of SRC results in better tree health, flavor and fruit storability. Consistently long- term applications of SRC has resulted in improved tree and shrub vigor and a significant increase in brix. Brix, a measurement of sugar, relates to mineral content and flavor. For more information on testimonials and test work please refer to www.borealagrominerals.com , particularly Juicy-Fruit Orchards, Chatham Orchards and Norfolk Soil and Crop test plots.

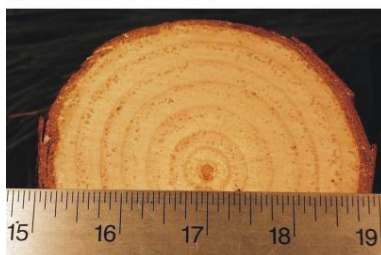
博莱在纽约时报上第一次看到佛蒙特大学Amy Trubek的工作，“新鲜采自佛蒙特州的枫树，品味风土”。Trubek博士的团队想看看枫糖浆与下伏基岩之间是否有关联。试验得出结论：长在石灰岩岩床上的树拥有最高含量的铜、镁、钙和硅石，他们相信这些元素在枫糖浆的味道上起到一定作用。页岩基岩上的树木其次，排在第三位的是片岩。她的研究不仅表明了土壤母质变化的基础上的味道的变化，矿物质含量的显著变化也导致了营养的增加。

博莱有很多客户在果园和葡萄园中使用SRC来证实了Amy Trubek的研究——即增加了矿物质含量。使用SRC让树木更健康、风味更佳、果实耐贮性更强。长期坚持使用SRC使树木和灌木的更有活力且显著增加了白利糖度。白利糖度是一种测量糖份的指标，与矿物质含量及风味相关。更多推荐与测试信息请参阅www.borealagrominerals.com，尤其是Juicy-Fruit果园、Chatham果园及诺福克郡土壤和作物试验田的案例。



Tree Growth Comparison

Species : White Pine
Location : Erin, Ontario
Comments : Plantation established on Golden Innisfree Farms in spring of 1990. Sample was taken from second node.



Species : Red Pine
Location : Cartier, Ontario
Comments : Clear cut reforestation established 1987. Sample was taken from second node.



Species : Jack Pine
Location : Cartier, Ontario
Comments : Clear cut reforestation established 1987. Sample was taken from second node.

Long recognized as an outstanding forest the Spanish River region, (where the deposit is located) is a testament to the effects of SRC on the growth and health of trees growing within the deposits footprint. Boreal has monitored plantation growth over the deposit vs trees of similar species grown on our test farm. This investigation demonstrated that even under the harsher climate conditions of northern Ontario, trees growing over the deposit performed better than trees cultivated on the farm.

西班牙河矿床所在的地区一直长有茂盛的森林，这是受到了SRC的影响，沿着沉积矿床的足迹生长出健康的树木。博莱监测了沉积矿床上植物的生长并对比了在我们的试验农场种植类似树种的生长。这项

调查表明，即使在安大略北部恶劣的气候条件下，生长在沉积物上的树木比在农场种植的树表现得更好。

Spanish River Carbonatite - Volcanic Minerals Plus® 西班牙河碳酸盐岩-火山矿物 Plus®

Singularly, the most important factor improving tree health, nutrient uptake and soil restoration is the elimination of aluminum and other metal toxicities. By effectively addressing this one problem all of these factors will be significantly improved without additional fertilizer. Ongoing trials using bulk SRC have shown results in well drained, base cation depleted acid soils, particularly where aluminum, iron and manganese toxicity is a problem. SRC is the most effective mineral input we have tested to combat soil metal toxicity.

In addition to combating soil toxicity SRC has demonstrated increased tree vigor and nutrient uptake, thus improving flavor and storability.

特别的是，改善树木健康、养分吸收和土壤恢复的最重要因素是消除铝和其他金属毒性。通过有效地解决这一问题，所有这些因素都会在没有额外肥料的情况下得到显著的改善。使用大量SRC进行的试验结果表明，在排水良好，盐基阳离子耗尽的酸性土壤，特别是有铝、铁和锰中毒问题的土壤，SRC是我们目前测试的打击土壤金属毒性最有效的矿物输入。

除了对抗土壤毒性，SRC已证明可以增加树木活力和营养物质的吸收，从而改善风味和耐贮性。

