Saline Waters - A Growing Problem

All waters, even rainwater, have some salts dissolved in them, so all could be called saline. The term saline is restricted to waters with concentrations that could cause harm to plants or people. Seawater is highly saline, many wells are moderately saline. For example, the well water used for irrigation at the Government Center exceeds standards for human consumption, but with proper management can be used on many plants. This would be called brackish water and the salts are derived from the geology of the area. Most domestic water supplies have low concentrations of salts and are not considered to be saline. Using domestic water in gardening, though, does not mean that we should not be concerned about salinity.

Before going any further it is worth remembering that salt is not just the sodium chloride that's on the table. Salts are combinations of electrically charged ions. These ions separate from one another when a salt dissolves in water. Water with dissolved sodium chloride and potassium nitrate contains sodium, potassium, chloride and nitrate ions. The most common ions in natural waters are:

sodium (Na^+)	chloride(Cl^-)	sulfate (SO_4^{2-})
calcium (Ca^+)	carbonate (CO_3^{2-})	boron (H_3BO_3)
magnesium (Mg^+)	bicarbonate (HCO_3^-)	

Different waters can have very different proportions of these ions and these proportions can change with time. Some typical analyses of City of San Buenaventura water can be seen in the following chart (1990 Annual Report of the City of San Buenaventura).

Ionic composition of some waters in the City of San Buenaventura

	Na^+	Ca^+	Mg^+	Cl^-	SO_4^{2-}	TDS	EC
Water sample	----------	----------	----------	(mg/l)	----------	----------	(uMHO)
1	200	259	70	92	839	1668	1990
2	45	92	191	44	210	645	874
3	28	59	21	20	140	316	580

Total dissolved solids (TDS) and electrical conductivity (EC) are two different ways of measuring the total amount of salts in water. The old way of taking a specified volume (l for liter) of water and boiling it down to the residue which is weighed (mg for milligram) gives TDS. The more modern technique is to measure the electrical current a water will carry (uMHO or microMHO), which is in proportion to the number of ions in the water.

Natural waters also contain low concentrations of many other elements. For most, the amounts are too low to be either harmful or beneficial to plants. The main exception is boron which can be a problem for sensitive plants, such as citrus and avocado, when in excess of 1 mg/l. Many well waters in our area contain potentially harmful levels of boron for plants.

In addition to the ions mentioned, there are also those that come from fertilizers and the soil. The main extra ions are potassium, ammonium, nitrate and phosphate. The concentrations of these will depend on the type of soil and the amounts and kinds of fertilizers applied, minus the amounts taken out by plants, held by the soil and lost by leaching.

In evaluating water for its potential to harm plants, it is necessary to look at total salinity, as well as the specific ions. Waters with a TDS in excess of 1000 mg/l or an EC greater than 1500 uMHO might pose problems for sensitive plants like photinia or vinca minor, and none at all to tolerant plants as myoporum and pittosporum. Waters with an excess of sodium and/or chloride (more than 100 mg/l) can induce symptoms that are similar to high levels of salinity.

In most cases, plants respond by initially having their leaf margins turn yellow and die. This happens first on

older leaves because they have had the longest time to accumulate the ions. Annual plants are often less affected than perennials, since they do not grow long enough to accumulate sufficient ions to cause damage.

As plants remove water from the soil the concentration of salts in the remaining water increases. Plants adapt to moderate increases, but if the plant is sensitive, it will slow growth in response. If the salt increase is small, the growth reduction will be small and acceptable. But if the level of fertilizer use is high, the water quality poor, or the soil has not been properly leached, the increased soil salinity could reduce growth seriously.

The effects of salinity are usually gradual on plants, unless too much fertilizer has been suddenly applied. Also, with some domestic water there is variation in concentration and kinds of salts in the water with time. The 200 mg/l of sodium in water sample 1 on the chart would be a problem if this were what the homeowner continuously received. However, according to city data, this house does get 94 mg/l at times. The better quality water serves to flush out the higher concentration salts. And this is how to practically deal with poorer quality water, occasionally leach the soil. When there are no leaching rains, we need to be more aware of the potential for salt accumulation in the soil. With proper plant selection and water management even extremely saline waters can be used.