CLAIMS

1. An apparatus for measuring water potential comprising:
    a. a housing comprising at least one portion that is water permeable;
    b. a volume changing material (VCM) capable of retaining water, wherein said VCM increases or decreases its volume in response to increased or decreased water concentration respectively, and wherein said VCM is in direct contact with an inner surface of said at least one water permeable portion of said housing;
    c. a compressible insert configured to maintain at least a predetermined inner pressure within said apparatus; and
    d. a receiver configured to engage the VCM, compressible insert or both at or above a predetermined threshold of water concentration and configured to transduce a signal when engaged, when disengaged, or both.
2. The apparatus of claim 1, wherein said VCM fills between 10-90% of the volume of space inside said housing.
3. The apparatus of claim 1 or 2, wherein said compressible insert fills any space inside said housing not filled by said VCM.
4. The apparatus of any one of claims 1 to 3, wherein said receiver is configured to translate a force applied by said VCM, compressible insert or both into an electrical or mechanical signal.
5. The apparatus of any one of claims 1 to 4, wherein said receiver comprises a pressure sensor, a traveling sensor, a force sensor, a valve, or a gauge.
6. The apparatus of any one of claims 1 to 5, wherein said water permeable portion comprises a porous material.
7. The apparatus of claim 6, wherein said porous material is a natural, synthetic, or a semi-synthetic membrane.

8. The apparatus of anyone of claims 1 to 7, wherein the compressible insert comprises a gas-filled inner volume.
9. The apparatus of any one of claims 1 to 8, wherein the VCM comprises a hydrogel.
10. The apparatus of any one of claims 1 to 9, wherein the VCM comprises a biocide.
11. The apparatus of claim 9, wherein the hydrogel is a biocide.
12. The apparatus of any one of claims 1 to 11, wherein the VCM comprises acrylic acid, methacrylic acid, 2-Bromoacrylic acid, 2-(Bromomethyl) acrylic acid, 2-Ethylacrylic acid, Methacrylic acid, 2-Propylacrylic acid, Sodium acrylate, Sodium methacrylate or derivatives thereof, sodium hydroxide, or homopolymers, heteropolymers or derivatives thereof polymerized with a crosslinker of di-acrylate, di-acrylamide, and di-vinyl.
13. The apparatus of any one of claims 1 to 12, wherein the VCM comprises Alkylacrylamide, N-(3-Aminopropyl)methacrylamide hydrochloride, N-tert-Butylacrylamide, Diacetone acrylamide, N,N-Diethylacrylamide, N,N-Diethylmethacrylamide, N,N-Dimethylacrylamide, N-[3-(Dimethylamino)propyl]methacrylamide, N-Ethylacrylamide, N,N′-Hexamethylenebis (methacrylamide), N-Hydroxyethylacrylamide, N-(Hydroxymethyl)acrylamide, (4-Hydroxyphenyl)methacrylamide, 2-Hydroxypropyl-methacrylamide, N-(Isobutoxymethyl) acrylamide, N-Isopropylacrylamide, N-Isopropylacrylamide, N-Isopropylmethacrylamide, Methacrylamide, or homopolymers, heteropolymers or derivatives thereof polymerized with a crosslinker of di-acrylate, di-acrylamide, and di-vinyl.
14. The apparatus of any one of claims 1 to 13, wherein the VCM comprises copolymers of maleic anhydride copolymer, polyvinyl alcohol copolymers, cross-linked polyethylene oxide, crosslinked carboxymethylcellulose or starch grafted copolymer.

15. The apparatus of any one of claims 1 to 14, further comprising a diaphragm between said VCM, insert or both and said receiver, wherein said diaphragm transfers force from said VCM, insert or both to said receiver.
16. The apparatus of any one of claims 1 to 15, wherein the apparatus is operatively linked to an irrigation system such that the irrigation system activates or shuts off in response to said transduced signal.
17. The apparatus of any one of claims 1 to 16, wherein the apparatus is operatively linked to a soil water potential measuring system.
18. The apparatus of any one of claims 1 to 17, for use in measuring water potential.
19. The apparatus of any one of claims 1 to 18, for use in effecting the water potential in water-containing media proximal to the apparatus.
20. A moisture sensor apparatus for measuring water potential at variable depths comprising:
    a. at least one apparatus of any one of claims 1 to 19;
    b. at least one variable extender configured to insert said at least one apparatus into a water containing medium at a predetermined depth;
    c. a transmitter configured to wirelessly transmit data concerning water potential measured by said moisture sensor apparatus.
21. The apparatus of claim 20, comprising a plurality of apparatuses of any one of claims 1 to 19, wherein said apparatuses are each separated by said at least one variable extender.
22. The apparatus of any one of claims 1 to 21, further comprising a solar panel configured to supply power to said apparatus, and wherein said solar panel is located in a region of said apparatus configured to be above ground during operation of said apparatus.