Cosmic trees and traditional knowledge of lunar rhythms

Potentials for innovative scientific research and bio-compatible applications

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World trees, cosmic trees

In many ancient cultures, trees are objects of worship, or there is a mythic Tree of Life, World Tree or Cosmic Tree that plays a central role.

The adoration of trees is well known from the Celtic culture. Several tribe names are an expression of the dimension taken by trees: the *Eburones* and the *Eburovices* contain the word *ibor* (yew, *Taxus baccata*), while the *Lemovices* took their name from the elm, *lem* (*Ulmus* sp.) (De Vries, 1977).

Norse or Germanic mythology is built on a tree called *Yggdrasil*, thought to be an ash (*Fraxinus excelsior*), although some commentators have suggested it may be a yew. There are few symbols in myths as challenging or as rewarding as this tree. A. Chetan and D. Brueton (Chetan & Brueton, 1994) describe it as follows: '*Yggdrasil is the guardian tree of the gods who maintained the fabric of the universe, and the axis that binds together the three worlds earth, heaven and underworld. From here the gods preside, and from his seat Odin can look into all three worlds at once. Yggdrasil rises to the sky, and its branches overspread the whole of creation. Three roots support it; one stretches to Hel, the world of the dead, another to the world of the frost giants and the third to the world of humans. At its feet are several springs tended by the goddesses of fate, the Norns, and also the wells of Mimir and Hvergelmir. […] The waters of the well of Mimir are the source of wisdom. […] Hvergelmir's spring is the source of eleven rivers, and serpents lurk nearby. Around the base of the trunk is coiled a huge serpent who continually gnaws the roots ….'.*

A deeper study of other myths and cosmovisions shows striking similarities, as mentioned by J. Narby (1995) A South American shamanic description under the influence of *ayahuasca*, a hallucinogenic drug, depicts almost the same World Tree, as a living spiritual column between Gods, Heaven and Earth, linked to waters and surrounded by a giant serpent, the Anaconda (Figure 1).

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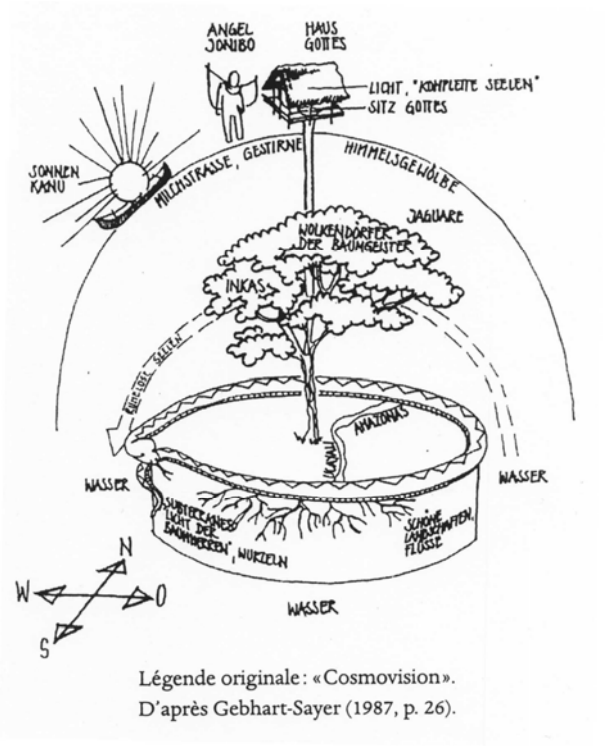

Figure 1 The central role of the tree in an amerindian cosmovision (after Gebhart-Sayer 1987, in Narby 1995).

These similarities, which cannot be explained by direct or indirect cultural influence, must have an explanation in a common psycho-spiritual constitution of human individuals, expressed in similar archetypes, as described by C.G. Jung.

One important aspect of this central role of trees in human culture and in our individual perception of nature is that they are embedded in different types of physiological cycles. These life rhythms are linked to the day-night-alternation, to the seasons (both from the apparent movement of the sun), and are also synchronous with cycles of the moon, of solar activity, of planets and with the zodiacal/stellar constellations. The cosmic dimension of life has always been mentioned in old cultures; scientific research (chronobiology) is now progressively discovering some of these rhythms related to the astronomic periphery, in plants and animals as well as in human life.

The present article mentions some examples of traditional knowledge of this type linked to trees. It presents some corresponding, pioneering scientific evidence, to demonstrate that the relationship between man and nature has also deep, far-reaching and unexpected dimensions.

Forestry traditions

According to documents from more than 2500 years ago, certain forestry practices and rules regarding tree felling and wood utilisation were carried out in observance of moon cycles, as was also done in agriculture and horticulture practices.

One can review the different types of rules followed for felling, pruning and coppicing. These rules are known in Europe and on other continents and stem from both traditional sources and present-day practitioners. The analysis of these rules shows that tree reaction is thought to depend on the specific date of the intervention. Special timber qualities and uses are also connected to such specific dates. The moon-related felling date supposedly ensures advantageous physiological reactions or special wood properties (Hauser, 1973; Broendegaard, 1985). Specific uses of wood based on well-defined properties mentioned in forestry felling traditions include: construction timber, shingles, wooden chimneys, firewood, wine barrels, cheese packaging boxes, longbows, wooden ploughs, resonance wood for musical instruments, etc. (Zürcher, 2000).

Role of scientific research

The aim of research lies in the critical examination of a possible element of objective truth underlying the above statements and in understanding the phenomena which could be responsible for the experiences described. Facts and practices must be separated from deviation and superstition. At stake here from the scientific point of view is usually the synodic lunar rhythm (period 29.5 days); much less research has been carried out on the role of the two other main moon rhythms (the sidereal and the tropic, both with a period of 27.3 days) in biological processes. A good review of scientific research on lunar rhythms in organisms has been published under the title 'Biologie des Mondes' (Endres & Schad, 1997).

Chronobiological (re)discoveries and confirmations

There have been a number of scientific studies carried out in relation to moon phases (as synodic lunar rhythm), dealing with elements of tree biology such as germination (Zürcher, 1992; Bagnoud, 1995) and the initial growth of tropical trees (where strong and systematic variations and their complicating aspects have been observed) (Zürcher, 1992, 1998). Recent research carried out jointly by several US Universities tested, at the level of secondary chemistry, the Central-American indigenous practice of timing the harvest of palm leaves for roofing by taking into account the moon phases. Significant differences appeared in carbon content and calcium content as well as in hemicellulose fraction, which could explain the effective higher durability (Vogt, Beard, Hammann, O'Hara Palmiotto, Vogt, Scatena & Hecht, 2002). Reversible, circadian (daily) lunar-synodic fluctuations of stem diameters (for trees held under constant conditions) (Zürcher, Cantiani, Sorbetti Guerri, Michel, 1998) provoked a controversial discussion (Vesala, Sevanto, Paatero, Nikinmaa, Perämäki, Ala-Nissilä, Käätiäinen, Virtanen, Irvine & Grace, 2000).

An interesting differentiating synthesis has recently been achieved by K. Holzknecht (2002) through long-term measurement of (bio-)electric potentials in European spruce and Swiss stone pine: while during the growth season the measured electric potentials followed a diurnal rhythm (responding to the known daily changes of light and temperature), during the winter period the potential variations were

correlated with the calculated circadian gravimetric tides during the waning lunar phases. At that time, the global curve exhibited a lunar and semi-lunar course. Interestingly, there are periods of rest during the growth season where the tidal correlation also becomes briefly evident. Until recently, the scientific objection to these observed phenomena was that the known physical forces (gravitational, geomagnetic) had too small variations to be considered as causal factors. A recent publication has approached this problem by developing a new astro-/geophysical model, which integrates simultaneously the static and the dynamic aspect of gravitation. This model leads to a 'quantisation' of time and demonstrates a rhythmic, reversible sun- and moon-related effect on the supra-molecular structure of water, thus revealing a possible 'zeitgeber' in chronobiology (Dorda, 2004).

In the utilitarian field of material technology, some studies concentrate on the relation between wood and water according to the felling date (drying process) and on the consequences for the wood properties (Zürcher & Mandallaz, 2001). Systematic and repeated tree fellings (6 x 5 spruce trees) in two opposing lunar phases from the point of view of the three rhythms mentioned (synodic, tropic, sidereal) were carried out in Zurich during the winter 1998-1999. This was followed by an analysis of the drying behaviour and determination of oven-dry density and compression strength, before exposing a series of samples to weathering conditions. While the fresh density of the felled trees, as a result of random selection for felling rank, was quite equivalent, significantly lunar-correlated variations appeared after the drying process in the oven-dry density and in the relative density (this is the value of oven-dry density in % of the initial density) (Figure 2). The significance is obviously due to the stronger variations in December and January; these variations are more marked for the outer sapwood samples than for the inner, drier heartwood material tested.

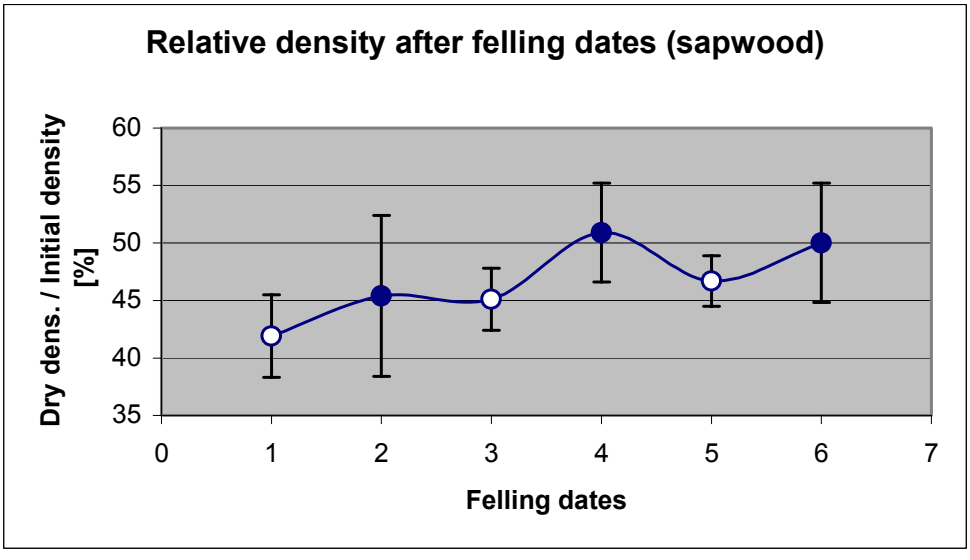

Figure 2 Systematic, lunar-correlated variations of European spruce-wood densities: Relative density (oven-dried/initial fresh density) of sapwood after 6 successive lunar-correlated felling dates in Zurich. 1 / 3 / 5: fellings before full moon, in ascending phase, in Pisces; 2 / 4 / 6: fellings before new moon, in descending phase, in Leo (mean values +/- standard deviations; after data in Zürcher and Mandallaz, 2001)

A further important indication of the reality of the investigated phenomenon is given by two similar, geographically independent research studies in this field with European spruce (J. Triebel (1998) with 120 trees; U. Seeling and A. Herz (1998) with 60 trees). These two previous investigations with 6 felling dates each, however, could not significantly indicate the influence of the felling date on the wood properties at a global level. But if the sapwood oven-dry density curves of the three sites and the three years in succession are compared, then it becomes obvious that from the felling date 3 (4) to the felling date 6 (7) significant systematic and parallel fluctuations between waxing moon ('full moon', fm) and waning moon ('new moon', nm) oven-dry density values exist (Figure 3). This means that for the whole of the 6 December and January nm-fellings, the kiln-drying density is significantly higher than that of the 3 fm-fellings of December. The relation to the December fm-value amounts to 11.6% and 9.0% respectively for Zurich, about 8.7% and 17.0% for Tharandt and about 12.0% and 9.1% for Freiburg Im Breisgau. To avoid misinterpretation, it must be stressed out that the lines connecting the punctual mean values of figures 2 and 3 have merely a visual function and do not correspond to effective measured values.

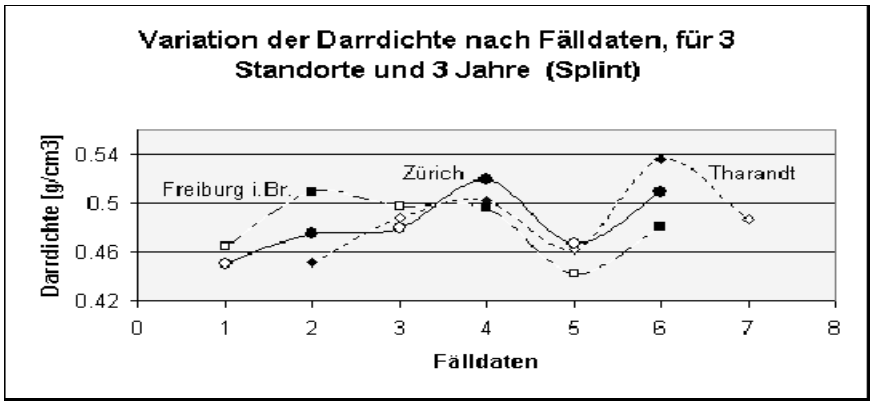

Figure 3 Systematic variations of oven-dried sapwood-densities of European spruce after successive lunar-correlated felling dates in 3 sites and 3 years. Zurich 1998-1999: plain line/Freiburg i.Br. 1997-1998: dotted line 1/Tharandt 1996-1997: dotted line 2. 1 / 3 / 5 / 7: fellings before full moon, as in Fig.1; 2 / 4 / 6: fellings before new moon, as in Fig.1 (according to Zürcher and Mandallaz, 2001; Seeling and Herz, 1998; Triebel, 1998)

For the determination of the compression strength for each of the four cardinal directions in the sapwood and the heartwood, eight evenly-grown samples per tree were tested. The data show a very close correlation with the value distribution of oven-dry densities for the sapwood as well as for the heartwood (correlation coefficients sapwood: 0.989 / heartwood: 0.971). In both cases the systematic differences between 'full moon' and 'new moon' samples of the series 3 – 6 were obvious. Sapwood as well as heartwood showed the most significant differences between felling date 4 (nm) and felling date 5 (fm): 17.8% and 22.6% respectively. For the whole investigation, the nm-average value in sapwood (47.2 N/mm²) surpasses the fm-average value (41.9 N/mm²) by 12.6%. The heartwood's nm-average value (40.7 N/mm²) surpasses the fm-average value (36.6 N/mm²) by 11.2% (Figure 4).

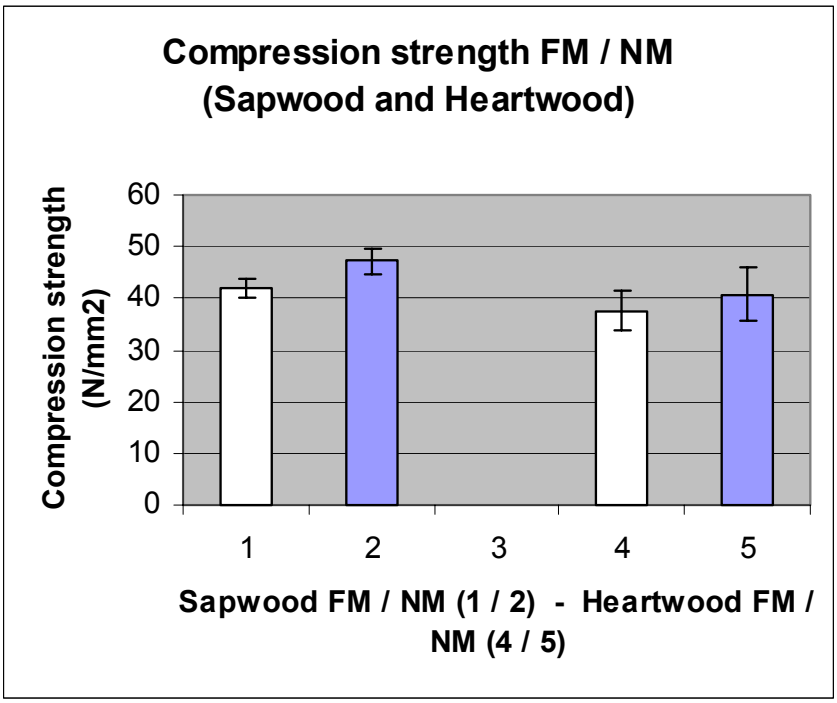

Figure 4 Comparative mean values of compression strength of sapwood (left) and heartwood (right) of European spruce (Picea abies) from successive lunar-correlated felling dates in Zurich. White bars: fellings before full moon, as in Fig.1; dark bars: fellings before new moon, as in Fig.1 (mean values +/- standard deviations; according to data in Zürcher and Mandallaz, 2001)

A comparison of the initial fresh densities of the samples illustrates the apparent reason for the traditional felling practices: from initially relatively homogeneous material (average fresh density of sapwood nm-samples was only 1.0% higher than the average of sapwood fm-samples; for heartwood samples it was 1.8% lower) it seems possible to regulate the drying behaviour and the final physical wood properties through an accurate choice of the felling date in relation to the position of the moon. This moon-related effect must be understood as additional to the influence of the site and to the effect of the season of the year. The analysis of the samples after 2.5 years of weathering suggests that these effects have a permanent character (Zürcher, 2003). In addition to mechanical properties and durability, traditional rules mention differences when the wood is used for energy. Unexpectedly, burning tests and statistical analyses published by Seeling (2000) show that samples from specific felling dates in 'waxing periods' actually have higher heat values than samples from corresponding dates in 'waning periods'. The results of a recent large-scale study of different sites in Switzerland made by the author confirm significant lunar periodicities in the drying process (water loss, shrinkage and relative density) of the wood samples. However, the differences between the global mean figures are much lower than in the previous studies.

A recent publication deals specifically with the role of the sidereal moon position. Some traditions, probably going back to the Chaldean and Egyptian cultures (Vreede, 1996), state that zodiacal constellations should be taken into account when working with plants. H. Flückiger and S. Baumgartner (2002) based their study of

Mistletoe (*Viscum album* L.) berries on the fact that the exact shape of a large variety of buds shows systematic reversible variations that can be mathematically defined with a single parameter λ (lambda) (Edwards, 1993). The same type of cyclic slight shape modification could be seen here at the fruit level, as well as a significant correlation with the zodiacal constellations in which the moon is positioned at the moment of sampling (Figure 5).

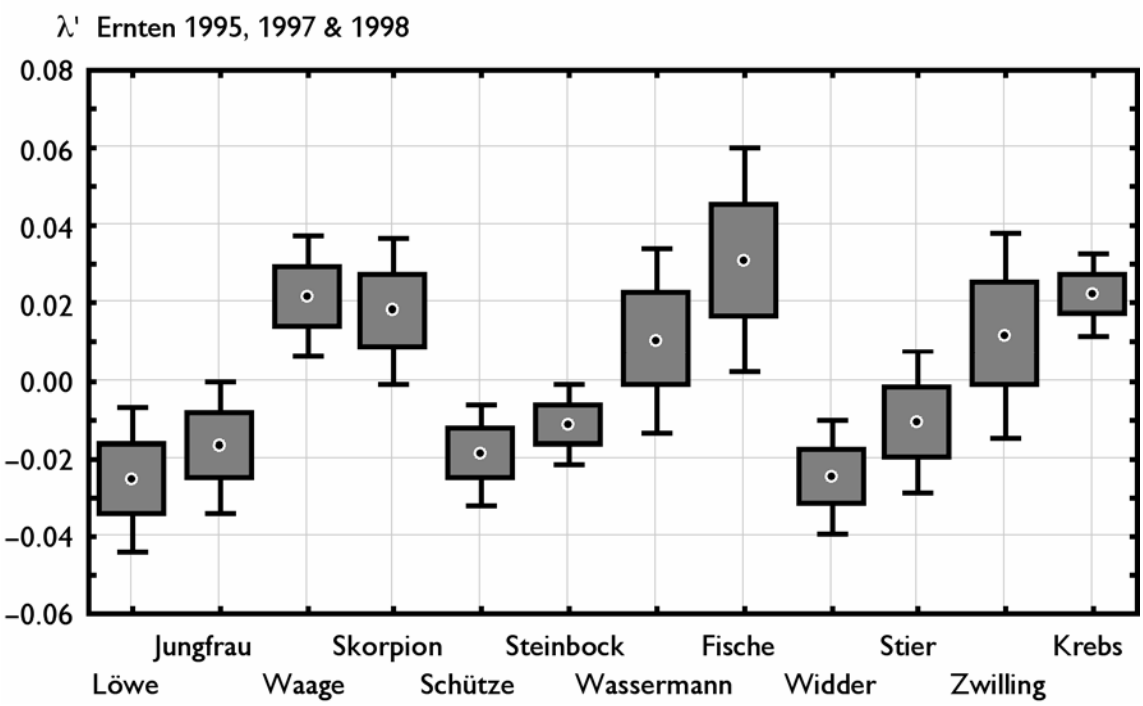

Figure 5 Values of λ (lambda) (mean +/- single and double standard deviation) of Mistletoe berries (collected 1995, 1997 and 1998) as a function of moon position in the zodiacal constellations (with the kind agreement of 'Elemente der Naturwissenschaften' and authors H. Flückiger and S. Baumgartner)

Lunar rhythms in the human organism

As mentioned in detail by Endres and Schad (1997), the influence of moon rhythms and positions is not limited to plants. Many scientific works also show a role in animal and human life. A good example is given by the human fertility cycle, which is clearly periodic. The Swedish chemist Svante Arrhenius (winner of the Nobel Prize for Chemistry 1903) found, as other studies have confirmed (e.g., Folin et al., 2001), the mean periods of menstruation and the incidence of childbirth to be 27.32 days: this is the same as the sidereal moon cycle, which is two days shorter than the synodic cycle. Furthermore, there was a correlation with electromagnetic fluctuations in the atmosphere, which also followed a sidereal cycle (Arrhenius 1898, cited in Morgan, 2001). A Brazilian analysis of the frequency of births confirmed this rhythm, and was in agreement with the results concerning natality in Germany obtained by Svante

Arrhenius (Mikulecky & Lisboa, 2002). Nevertheless, these last authors state that this topic remains controversial.

Similarly to this first (sidereal) periodicity, a recent medical analysis shows that mortality variations in general and cardiovascular mortality in particular are correlated to the synodic moon phases in the form of a semi-lunar wave. Fourier analysis of these 1.8 million and 1.1 million respective cases of death indicates in addition shorter variation periods of 3.7 and 2.96 days (1/8, resp. 1/10 of the lunar month) (Strestik, Sitar, Predeanu & Botezat-Antonescu, 2001).

A synthesis and its prerequisites

On this basis, a fruitful exchange is possible between scientists and foresters who are aware of the 'cosmic' dimension of trees and its philosophic/scientific meaning. As a matter of fact, the works presented here on astronomic rhythms in organic life give an insight into an unexpectedly common level between trees and human beings. They lead to a rehabilitation of parts of ancient, almost forgotten knowledge. One positive consequence is the enhancement of the intrinsic value of each tree, from a physical, and also a social and spiritual point of view.

From the epistemological and methodological point of view, a synthesis between traditional perception and modern thinking seems possible if:

- Thinking is actively observed and recognised in its real essence, offering the relational component of the process of knowledge, binding together the diverse elements of observation. The scientific elaboration of a monistic ('one-world') science of knowledge was the fundamental achievement of Rudolf Steiner [27,28], making multiple practical and innovative applications possible, from medicine to agriculture.
- The mind-matter discontinuity is bridged. In his book 'The Web of Life', Fritjof Capra (1996) emphases in an analogous sense that mind should not be considered as a thing, a product of brain physiology, but as a process – the very process of life. 'The organizing activity of living systems, at all levels of life, is mental activity'. Citing Bateson: 'Biological forms consist of relationships, not of parts, … , and this is also how people think.'
- Nature is objectively considered as intelligent. A new step in this direction was recently made by the anthropologist Jeremy Narby (2005), presenting experimental and scientific examples and arguments from interviews with traditional healers and with researchers in the life sciences. As a result, Narby proposes a world concept explained by science which integrates the experience of shamans.

Potentials and perspectives

These efforts towards a new understanding of chronobiological phenomena and the discovery of unexpected dimensions could allow diverse promising applications. Examples of potential activity fields include:

- 'Cosmobiological' plant breeding and selection, respecting the fundamental nature of species and avoiding artificial modification of the genome (a type of 'cosmo-genetics');
- High-quality reforestation, with disease-resistant seedlings from tree nurseries with high germination rates;
- Ecological and biocompatible wood technology, using, where appropriate, naturally decay-resistant timber from chronobiologically correct tree fellings.

Taking into account 'time' as a basic environmental factor makes it possible to develop bio-technologies in the real sense of the term, bringing the organisms (in our examples: the plants and their specific substances) to the expression of their full potential.

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