

An International Standard for Forest Garden Products (FGP)



**International Analog
Forestry Network
approved standards**

**F.G.P Inspection &
Certification (Pvt) Ltd.**

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Sponsored by:

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1. This Standard was developed for the International Analog Forestry Network (IAFN) in response to the demand for a certification system that conforms to the principles of Analog Forestry*.
2. Analog Forestry is a management response to the increasing demand for agricultural products from land use that is environmentally sustainable and socially just. As Analog Forestry seeks to develop native biodiversity it precludes the use of synthetic chemicals or bio-concentrable substances.
3. This Standard lays down minimum principles which must be complied with before any agricultural or silvicultural products can be placed on the market with claims or labelling that implies that they have been produced by the practice of Analog Forestry.
4. This Standard aims:
 - a. To protect consumers against deception and fraud in the market place and from unsubstantiated product claims.
 - b. To protect producers of Forest Garden Products (FGPs) against misrepresentation of other forest or silviculture products as being from certified Forest Gardens.
 - c. To harmonize the goals of Organic Production, Sustainable Development, Biodiversity Conservation, Climate Responsibility and Secure Livelihoods in the practise and labelling of FGPs.
 - d. To ensure that all stages of production, processing and

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marketing are subject to inspection and meet minimum requirements.

- e. To provide a guide to farmers contemplating conversion to Forest Garden farming.
 - f. To develop sustainable landscapes which retain their environmental functions.
5. Forest Garden farming systems refer to those practicing Analog Forestry or the restoration of native biodiversity through the use of organic agriculture, crop diversification and system maturation. The products of these systems can be defined as Anthropogenic Tree Dominated Ecosystem Products (ATDEPs). Such farming systems include those referred to as traditional forestry, home gardens, agro-forestry or permaculture. Irrespective of which term is used, the basic principle remains the same: maturing a tree dominated ecosystem towards the production of safe, high-quality agricultural or silvicultural product while avoiding toxins and building upon the local biotic capital. In crop management, Analog Forestry has much in common with organic farming: the same emphasis is placed on the use of renewable resources, and on the need for the conservation of energy, soil and water resources with the concomitant maintenance of environmental quality. The production is integrally linked to the landscape needs, with the utmost restrictions on external inputs such as fertilizers, pesticides, fossil energy, alien invasive species and invasive exotic genes.

ATDE's were a fact of many landscapes through at least three millennia. The first such landscapes would probably have been comprised exclusively of native species, but with the passage of time and the movement of humans, the representation of exotic species has increased in all countries. These human-made ecosystems range from the monocultures to polycultures. Monocultures tend to require higher external inputs and polycultures tend to require lower external inputs. Monocultures tend to reduce biodiversity and polycultures tend to increase biodiversity. Monocultures tend to reduce soil organic matter and polycultures tend to increase soil organic matter. Irrespective of the type of management system chosen, are all Tree Dominated Ecosystems.

6. This Standard does not address Non-Timber Forest products (NTFPs) of natural forests. The non-timber resources of forests have always been critical to meeting the basic needs of the rural population and have been major commercial products since they first entered international trade many centuries ago. However, the exclusive valuation of forests in terms of timber extraction posed an immediate threat to the subsistence-base of many forest dwelling communities. Historically, the dismissive term 'minor forest products' was applied to

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the diverse array of useful forest materials other than timber. The epithet 'minor' is indicative of the extent to which these products were grossly undervalued. NTFPs which originate only from natural forest systems. In this definition, the presence or absence of humans does not constitute a differentiator of natural forests. A system in which humans live but do not affect natural species and ecosystem frequencies is still considered to be a natural system. Humans living in and affecting the frequencies of natural biodiversity, however, create anthropogenic systems. A natural forest is identified by its biodiversity and sustainability status.

7. The traditional home gardens in many countries have generally maintained a high degree of biodiversity and have had a low reliance on external inputs. They can form the foci of ecosystem restoration in rural areas if biomass gain and system maturity are encouraged.
8. Analog Forestry is a land management system that entails significant restrictions on the use of fertilizers and pesticides which may have a detrimental effect on the environment or result in the transmission of residues or toxic secondary products to agricultural products. Analog Forestry also requires that the practitioner encourage non-crop biodiversity and design the cropping system in a manner analogous to the mature, native ecosystem.
9. The consequence of the practice of Analog Forestry is the establishment of a Forest Garden, grown with adherence to structural and functional design; the products are termed Forest Garden Products (FGPs) for the purposes of this Standard.
10. A Standard for FGPs differs from standards of other forestry produces in that the design as well as production procedures are an intrinsic part of the identification, labelling of and claims for such products.
11. The Standard provides a framework for the industry covering production, labelling and inspection and aims to encourage biodiversity-friendly silviculture practices by protecting consumers and ensuring conditions of fair competition between producers of products labelled as certified FGP.
12. The Standard will provide a more distinctive market profile by ensuring transparency at all stages of production and processing, thereby improving the credibility of these products in the eyes of consumers.
13. This Standard will ensure that all workers in the production process are treated fairly and obtain a benefit by participating in maintaining these standards.

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14. This Standard will ensure that a fair and equitable trading relationship is developed along all links of the supply chain.
15. This Standard will provide for the certification of sequestered Carbon in AF ecosystems in different stages of maturity. This is a voluntary standard and growers wishing to be certified under this Standard will incur extra work by the certifier (Annex VIII).
16. A transition or conversion period from initiation of the Forest Garden Farm Plan (FGFP) to a functioning Forest Garden is necessary. This period must be indicated by the FGFP organization, which is approved or accredited to assess and certify producers and operators and approved by the Standards committee.
17. This Standard requires the identification and nomination of both environmental and species indicators of the state of the ecosystems being surveyed (Annex III).
18. The objectives of such certification are:
 1. To ensure a clear verifiable audit trail for every certified product.
 2. To provide a means of protecting the integrity of the industry.
 3. To enhance trade in Forest Garden Products through maintaining uniform standards.
 4. To enhance the representation of native biodiversity.

Analog Forestry is a system of growing trees and plants that seeks to establish a tree-dominated ecosystem that is analogous in architectural structure and ecological function to the original climax and sub-climax vegetation community. Thus, Analog Forestry draws design input not only from traditional models but also from the natural forest. When an ecosystem is designed to be analogous to the indigenous climax state, the efficiency and dynamics of the natural processes can be replicated. These quasi-natural forests are designed to mimic the structural and functional aspects of indigenous forests and are referred to as analogue forests. In addition to their ecological characteristics, analogue forests are also designed to provide economic benefits. However, it is not until all the ecological requirements of the location are satisfied that economic values of species are considered. Therefore, an analogue forest may be comprised of natural and exotic species in any proportion, the contribution to structure and function being the overriding factor that determines its use.

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Section 1

1. Scope of the Standard

- 1.1. This Standard applies to the following products which carry or are intended to carry descriptive labelling referring to Analog Forestry production methods for:

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- a. Unprocessed plants, plant products,
 - b. Animals or animal products,
 - c. Ecosystems or ecosystemic products, and
 - d. Processed products derived from (a,b,c) above.
- 1.2. A product will be regarded as bearing indications referring to Analog Forestry production methods where, in the labelling, advertising material or commercial documents, the products or its ingredients, is described by the terms Forest Garden, Anthropogenic Tree Dominated Ecosystem, Restored Ecosystem or words of similar intent.
- 1.3. Products derived from recombinant-DNA technology are not compatible with the principles of Analog Forestry and therefore are not permitted under this Standard.
- 1.4. This Standard applies without prejudice to other standards governing the production, preparation, marketing, labelling and inspection of the products specified in paragraph 1.1.

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Section 2

Definitions :

2.1 All documents, contracts or certificates issued under these standards shall be interpreted using the following definitions:

Accreditation

Procedure by which an authoritative body gives a formal recognition that a body or person is competent to carry out specific tasks.

Accredited Certifying Organization

An organization that has been evaluated by the IAFN-FGP certification system as having the capacity to perform inspections and maintain audit trails. These can be specifically for AF, or be existing certifiers for organic, Fair trade, or forest that can incorporate AF into their standards process and are members of IAFN.

Agro forestry

Polyculture in silviculture, with economic design goals, and often involves a simplification and formalization of home gardens.

Ayurvedic

Traditional system of medicine common to India and Sri Lanka.

Analog Forestry

A silvicultural system that seeks to create a tree dominated ecosystem that is analogous to the original natural ecosystem in architectural design and ecological function.

Anthropogenic Ecosystems

Comprised of both native and exotic species in any particular place. Humans have impacted the habitats with a frequency or intensity to change established seral patterns.

Bio concentrable substances

Substances that are toxic that are often found in low concentrations in the environment, but are capable of being concentrated within certain plants or organisms.

Biodiversity or Biological diversity

The variability among living organisms from all sources including inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems.

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Biodynamic

Agricultural practices based principally on the work of Rudolf Steiner and subsequent developments derived from practical application, experience and research.

Biological resources

Includes genetic resources, organisms or parts thereof, populations, or any other biotic component of ecosystems with actual or potential use or value for humanity.

Biotechnology

Any technological application that uses biological systems or living organisms or derivatives thereof, to make or modify products or processes for specific use.

Biotic capital

The volume and quality of biomass in any given area.

Buffer Zone

A clearly defined or identifiable boundary area protecting natural resources and habitats from degradation.

Connectivity

The ability of any landscape elements to facilitate the movement of organisms and gene flow between habitat patches.

Corporate smallholders

Those who manage their holding in a cooperative or community manner.

Corridors

Semi-natural or natural habitats that provide connectivity between habitat patches.

Crop diversification

To add diversity to the managed area through the introduction of crops or cropping patterns in a manner that enhances biodiversity.

Domesticated or cultivated species

Species in which the evolutionary process has been influenced by humans to meet their needs.

Ecosystem products

Products that are created by ecosystem function; all species of a given ecosystem contribute to these functions.

Exotic species

Species that have been introduced in more or less recent times, deliberately

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or by accident, by human or natural hazards.

Forest Garden Farm Design (FGFD)

A detailed plan of the existing physical variables on a property, with a superimposition of the developments due to be done or features to be changed as a consequence of using Analog Forestry design (see Annex IV).

Genetic material

Any material of plant, animal, microbial or other origin containing functional units of heredity.

Genetic resources

Genetic material of actual or potential value.

Habitat

The place or ecosystem where the organism or population naturally occurs.

Home garden

A tree-covered, domestic compound that has at least 40% of the shade levels of the original forest.

Indicator Species

Organisms that correspond to a certain level of biodiversity. The term refers to those plants or animals that indicate or identify the ecological and sustainability status of the farm under investigation. Indicator species suggest the state of maturity of the ecosystem, will respond to the levels of toxins that are present or absent, and can be co-related with good Analog Forestry management practices.

Individual smallholders

Those who manage their holdings without the use of outside labour.

IAFN

A membership network of AF practitioners, researchers, buyers, GO's, NGOs etc, organized at their levels of interest regarding AF. This membership body develops the standards and finalizes them at the next AGM of the members. The IAFN is the accreditation body for potential certifiers.

Industrial Forestry

The use and management of tree species to create a tree dominated ecosystem that is designed to produce a single crop in the largest quantities over the shortest possible time period, using scientific knowledge systems. This system generates monoculture tree plantations.

Invasive species

Exotic or native species that invade ecosystems, having a negative impact on native species.

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Ingredients

The substances, including additives, used in the preparation of products.

Inspector

A person deemed by an accredited certifying organization to have the expertise and authority to inspect producers or operators for certification purposes.

In-situ conditions

Conditions where genetic resources exist within ecosystems and natural habitats, and, in the case of domesticated or cultivated species, in the surroundings where they have developed their distinctive properties.

In-situ conservation

The conservation of ecosystems and natural habitats and the maintenance and recovery of viable populations of species in their natural surroundings and, in the case of domesticated or cultivated species, in the surroundings where they have developed their distinctive properties.

Keystone species

A species on which the persistence of large numbers of other species of ecosystems depends and that, if introduced in former times, are adapted and co-evolved with the existing conditions and species.

Landscape

A heterogeneous land area composed of a cluster of interacting ecosystems that is repeated in similar form throughout. It is usually defined by a functional boundary such as watershed, a physical boundary such as soil, or a biological boundary such as vegetation. For the purposes of this Standard, Landscape will be considered synonymous with the farm plan when the farm is smaller than the watershed where it is located. When the farm exceeds the limits of the watershed, the limits of the landscape will be the farm boundaries and determined by the certification body.

Marketing

Holding or displaying for sale, offering for sale, selling delivering or placing on the market in any other form.

Native species

Species that propagate without deliberate human support, that are not introduced in recent times, and that if introduced in former are adapted and co-evolved with the existing conditions and species.

Native Ecosystems

Comprised of the original species that existed in any particular place. In undisturbed habitats, the native species occur in established seral patterns,

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and humans have not changed these formations and processes.

Operator

Any person who is involved at any stage of the chain of production, including storage, processing, packing, transporting, retailing, displaying, importing or exporting of products as referred to in Section I, or who markets such products.

Organic crops

Crops produced in soils of enhanced biological activity determined by the condition of the soil ecosystem, its humus levels, aggregate structure, and feeder root development, such that plants are fed through the soil ecosystem and not primarily through soluble salts added top the soil. Plants grown in such systems take up essential soluble salts that are released from soil humus colloids, at a rate governed by warmth.

Organic Farming

Systems that rely to the maximum extent feasible upon ecosystem management methods such as crop rotations, residue incorporation, animal manures, legumes, green manures, mechanical cultivation, Bio Dynamic composts and preparations, fermented plant sprays, micro-organism inoculation of approved species, approved mineral bearing rocks and biological control techniques in order to maintain soil productivity and tilt, to supply high quality plant nutrients and to control weeds, insects and other pests or diseases.

Silvicultural products

Products that emanate from trees, orchards and tree plantations.

System maturation

The uninterrupted movement of any ecosystem in seral succession.

Production (Biologic)

The creation of biomass by the production of photosynthetic goods and services for self-maintenance or for the maintenance of the biosphere.

Production (Economic)

The creation of value or wealth by producing goods or services either for self-consumption or for the market.

Permaculture

A crop management system that was designed as an integrated, evolving system of perennial or self-perpetuating plant and animal species useful to humans. It is in essence a complete agricultural ecosystem, modelled on existing but simpler examples.

Sustainable use

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The use of components of biological diversity in a way and at a rate that does not lead to the long-term decline of biological diversity, thereby maintaining its potential to meet the needs and aspirations of present and future generations.

Total Ecosystem Management (TEM)

A resource-use methodology that is developed with specific reference to the ecosystem that is being managed. Where it exists, traditional management knowledge that is of antiquity provides the basis for the development paradigm. In other instances, the scientific knowledge of that ecosystem and its links will provide the design parameters. The TEM approach seeks to achieve sustainable development based on the maintenance of local biodiversity, cultural diversity and environmental health. A critical element of the TEM approach is to ensure the maximum independence with an appreciation for the interdependence of local communities.

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Section 3

Production Requirements:

3.1 The principal aims of Analog Forestry include :

- 3.1.1 Producing food that is safe and high in nutritional value
- 3.1.2 Producing wood and fibre in a sustainable manner
- 3.1.3 Facilitating the maturity of the production ecosystem
- 3.1.4 Maintaining and enhancing the fertility of soils
- 3.1.5 Providing habitat for native species
- 3.1.6 Restoring degraded ecosystems
- 3.1.7 Creating value addition opportunities for agricultural produce
- 3.1.8 Ensuring a fair return for farmers
- 3.1.9 Building up sequestered carbon stocks
- 3.1.10 Reducing Fossil Carbon Footprint
- 3.1.11 Assisting to clean water and enhance the hydrologic cycle
- 3.1.12 Developing ecosystems with high CCN * potential

3.2 Analog Forestry production systems require :

The filing of a Forest Garden Farm Design^{1*} (FGFD) with an Analog Forest application.

- Evidence of erosion control and soil conservation measures.
- A clear audit trail with records as set out in Annex III be maintained.
- Production methods as set out in Annexes I and II be satisfied.
- Only products composed of substances listed in Annex II may be used as plant protection products, fertilizers, soil conditioners, foliar sprays, animal feedstuffs or animal products.
- Seeds and plant propagation material treated with substances not included in Annex II but authorised for use in general agriculture, may be used where it can be demonstrated to an approved certifying organization that non-treated product of an appropriate variety of the particular species or a substitute was unavailable.

¹ *Forest Garden Farm Design (FGFD): All applicants will be required to have begun the development of a FGFD plan before certification can be given. The plan, however rudimentary, must accompany the initial report. Subsequent development of the FGFD and its confirmation on farm will be a significant evaluator of progress. In preparing the plan, the AF concepts of Structure-Function-Design = Plan, should be clear.

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3.3 For a substance to be added to Annex II, the applicant must submit a full proposal giving reasons for its inclusion to the IAFN FGP certification committee for consideration.

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Section 4

4. Accreditation System

4.1 In order to become an approved certifying organization, an organization must make application to The Forest Garden Product certification committee of the International Analog Forestry Network for membership. For an organization to become an approved certification organization, the following requirements will be the minimum that is taken into account by the IAFN.

- The organization is an incorporated body where the profits are utilized in furtherance of the goals of Analog Forestry, organic agriculture or sustainable land management and biodiversity conservation.
- The organization operates on a national or international basis and will provide a certification program to documented standards which comply with all requirements of this Standards.
- The organization provides the service to all with no prejudice.
- An inspection protocol and procedures to be used, including a detailed description of the inspection measures and precautions the organization will undertake to impose on operators subject to its inspection.
- The penalties which the organization intends to apply where irregularities are found.
- The availability of appropriate resources in the form of qualified staff, inspection competence, technical and administrative capacity exists.
- The objectivity of the organization with respect to operators subject to its inspection.

4.2 After an organization has become approved, the IAFN-FGP compliance sub-committee must :

- a. Ensure that the inspections that are carried out by the accredited organizations are objective.
- b. Perform a random verification process to monitor inspections.
- c. Take cognizance of any infringements found and penalties applied, and
- d. Withdraw the approval of any organization where it fails to satisfy the requirements referred to in (a) to (c) or no longer fulfils the requirements specified in paragraph 4.3 below.

4.3 An accredited certifying organization must:

- a. Ensure that inspection activities and precautions specified in Annex III are applied to activities subject to its inspection.

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- b. Make available, on a commercial, in-confidence basis, on a mutually agreed date, a list of certified operators to the relevant governmental authority in each country of operation.
- c. Not to disclose information and data it obtains in this inspection activities other than to the operator responsible for the undertaking concerned and on a confidential basis to the IAFN-FGP compliance committee.
- d. Make available to a designated official auditor, for inspection purposes, access to offices and facilities together with all information and assistance deemed necessary to establish compliance with this Standard.

4.4 Any operator who produces, prepares or imports products as specified in Section 1 for the purpose of marketing such products as Forest Garden Products must be certified for the activity through an accredited certifying organization.

4.5 In order to obtain such certification, the following information must be provided to an accredited certifying organization :

- a. The name and address of the operator.
- b. The location of the farm or premises where production, importation, processing or packaging will be carried out.
- c. The nature of the operation and the products concerned.
- d. An undertaking from the operator to carry out operations in accordance with this Standard.
- e. In the case of a silvicultural or agricultural holding :
 - Whole Farm Plan as specified in Annex IV.
 - The history of management of the farm including inputs.
 - The date on which the producer ceased to apply products not compatible with the production requirements of this Standard.
 - Where applicable, a summary of all the practical measures to be taken, at the enterprise level, to ensure compliance with this Standard.
- f. Where the inspection covers a community with contiguous land under certification, 10% of the participating community members holdings will be inspected.
- g. Where the inspection covers a community without contiguous land under certification, the 10% sampling can be done only if there is an effective ICS in place.
- h. Where there is no contiguous land and no ICS, all farms will be inspected.

4.6 Certification of all production, processing, handling, transport, storage

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and sale of certified products is contingent on an accurate and up-to-date records of the enterprises concerned. The availability of such records is not only vital to inspectors assessing an operator applying for certification, it is also essential to maintain a clear audit trail for the consumer.

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Section 5

5. Indications that Products are Covered by an Inspection Scheme

5.1 An indication that products are covered by regular inspection schemes as detailed in Annex III may appear on the labelling or promotion of products as specified in Section I only, where such products:

- a. Satisfy the requirements of this Standard.
- b. Have been subject to inspection arrangements as referred to in Section 4 throughout the production and preparation stages.
- c. Have been produced or prepared by an operator whose undertakings are subject to inspection by an accredited organization and has been granted the right to use the terms Forest Garden Products.
- d. Are packed and transported to the point of retail sale in accordance with the requirements of Annex III.
- e. Include the following information on the label of goods, either wholesale or retail sale :
 - i. The name and any registered mark of an accredited certifying organization.
 - ii. An identification of the producer or processor.
 - iii. The level of certification.
 - iv. Lot number of producer [this number will be to supplied by the producer inspected, and will reference the field, date, and other basic information from the records from the farmer(s)].
 - v. Any other identification required locally.

5.2 An accredited certifying organization must:

- i. Ensure that when a product does not comply with the requirements of Sections 3 and 4, all such non-complying product is removed from sale as labelled.
- ii. Where a gross infringement or an infringement with prolonged effects are found, withdraw from the operator concerned the right to use the labelling indications covered by this Standard for a period that is determined appropriate.

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Section 6

6. Labelling

6.1 The labelling and advertising of a product specified in paragraph 1.1 (a,b,c,d) of Section 1 may refer to Analog Forestry production methods only where:

- Such labelling and advertising shows clearly that it relates to a method of ecological reconstruction.
- The product was produced in accordance with the requirements of Section 3 or imported under arrangements laid down in Section 8.
- The product was produced, processed or exported by an operator who was subject to an inspection system as set out in Section 5 or Section 8 as appropriate.

6.2 The labelling and advertising of a product specified in paragraph 1.1 (a,b,c,d) of Section 1 may refer to Forest Garden Products where:

- Such indications show clearly that they relate to a method of ecological reconstruction and are linked with the name of the produce in question as obtained from the property.
- All ingredients of silvicultural or environmental products must be derived from gardens or sources in accordance with the requirements of Section 3, or imported under the arrangements laid down in Section 8.
- Only substances listed in Annex II were used during the production phase.
- The product has not been subject, during preparation or processing, to treatments involving ionizing radiation or substances not listed in Annex IV.
- The product was produced by an operator subject to the regular inspection system as set out in Section 4.

6.3 Forest Garden or organically derived ingredients must be used if available. However, notwithstanding paragraph 6.2, ingredients not satisfying the requirements may be used in the preparation of certain products referred to in paragraph 1.1 (a,b,c,d) of Section 1 where such ingredients:

- a. Are of silvicultural or agricultural origin and are either not produced in the country concerned or not produced in sufficient quantities in accordance with the requirements of Section 3.
- b. Do not exceed 5%(mass/mass) of the content of the ingredients of Forest Garden or Organic agricultural origin in the final product.

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- c. Are approved by a certifying organization for use either generally with appropriate restrictions or for specific use by a particular operator.

6.4 Where there is no Forest Garden or organic source of the product available, the labelling and advertising of a product as referred to in paragraph 1.1(a,b,c,d) of Section 1, which has been prepared partly from ingredients not satisfying the production requirements of Section 3, may refer to Analog Forestry Production methods provided that:

- a. At least 50% of the ingredients of agricultural origin satisfy the production requirements of Section 3.
- b. If the producer satisfies the requirements of paragraphs 6.2 (d) and (e), the reference to Forest Garden Production is included only in conjunction with the ingredient or ingredients which satisfy the production requirements of Section 3.
- c. The ingredients and their relative levels appear in descending order (mass/mass) in the list of ingredients.
- d. The ingredients appear in the same colour and with identical style and lettering as the other ingredients.

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Section 7

7. Implementation of the Standard

7.1 During a transitional period expiring January 2008, reference may be made to conversion to Analog Forestry management methods by providing on the labelling and in promotional material of a product specified in Section 1, where it is composed of a single ingredient of agricultural origin, provided that:

- The requirements referred to in paragraphs 6.1 or 6.2 of Section 6, as appropriate, are fully complied with, except that concerning the length of the conversion period referred to in Annex I, Section A, paragraph 1.
- The indications concerned do not mislead the purchaser of the product regarding the difference from products which satisfy all the requirements of this Standard.
- Compliance with (a) above has been duly checked by an accredited certifying organization.
- Derogations may be made in cases of extreme climatic or other extenuating circumstances (such as flood, fire, extreme drought, etc.); exemptions may be made on a case by case basis, on submission of a report from an accredited certifying organization.

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Section 8

8. Import and Export of Product

8.1 Products specified in Section 1 which are imported may be marketed where:

- A competent authority in the exporting country has issued a certification stating that the lot designated in the certificate :
 - Was obtained within a system of production with rules equivalent to those laid down in Section 3.
 - Was subject to a system of inspection recognized as equivalent to that laid down in Section 4.
- The labelling of the product complies with this Standard.
- An operator who imports organic product with the intension of marketing the product is certified in accordance with paragraph 4.4 of Section 4.

8.2 The certificate referred to in paragraph 8 .1 (a) must accompany the goods with the original copy to the first consignee. Thereafter the importer must keep the certificate at the disposal of the approved certifying organization for not less than three years.

8.3 All export of product must be accompanied by a certificate from an accredited certifier ratified for inspections in the country of origin of the export.

8.4 Approvals or certificates to import or export products as specified in Section 1 will be withdrawn if products so labelled are shown not to satisfy the requirements of this Standard.

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ANNEX I

PRINCIPLES OF ANALOG FORESTRY APPLICATION AT FARM LEVEL

A. Plants and Plant Products

1.1 These principles must normally have been applied on the land for at least three years before the harvesting of products covered under Section 1. Accredited certification agencies may decide on certain justifiable circumstances, to extend or reduce that period, on the basis of previous use of the land and subject to suitable evidence that non-approved inputs had not been used during the previous three years.

1.2 The natural process of seral succession must be facilitated.

- Disturbance of both the above-ground and below-ground components of the ecosystem will be minimized.
- Nutrient transport webs will be a major contributor to plant nutrition.
- Soil organic matter increase.
- Reintroduction programs will be used where needed.

1.3 The fertility and biological activity of the soil must be maintained or increased by any one, or combination, of the methods endorsed by an accredited certification organization, such as:

- Cultivation of legumes, green manures or deep rooting plants in an appropriate multi-annual rotation program.
- Incorporation in the soil of composted organic material from sources according to the principles laid out in this Standard.
- The use of fully composted organic matter derived from selected sources as listed in Annex II.
- Application of biodynamic and microbial preparations.
- Tillage techniques.
- Mulching both live and dead.
- Maintenance and management of livestock.
- Using root exudates of living tree species.
- Re-mineralization.

1.4 Shade shall be developed to represent 40% shade through the farm using designs such as:

- Patch or clump plantings.
- Hedgerow or boundary plantings.
- Stream or gully plantings.

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- Random or patterned Individual plantings.

1.5 Pests, diseases and weeds may be controlled by any one, or a combination, of the measures endorsed by an accredited certification agency, such as:

- Choice in appropriate species.
- Biological control.
- Appropriate rotation or management.
- Specific biodynamic measures.
- Approved pathogens.
- Mechanical cultivation.
- Mulching and mowing.
- Grazing of livestock.
- Manual control.
- Humane traps.
- Baited traps.

1.6 Indicator species will be used for monitoring, such as:

- Choice of appropriate species.
- Above-ground.
- Below-ground.
- Identification of significant species complexes.
- Microbial techniques.

B. Livestock - Animal Biodiversity

2.1 In all Forest Garden systems it is important to maintain a high level of animal biodiversity both as livestock and wild in order :

- To improve and maintain the fertility of the soil through manure.
- To maintain and enhance natural pest control systems.
- To control weeds through grazing.
- To conserve native biodiversity.

2.2 Unless an accredited certifying organization grants an exemption due to limitations in size or structure of the Forest Garden in question, such as speciality plant production or herding etc., livestock must be included in a Forest Garden (the livestock may be native fauna).

2.3 Maintenance of livestock must be guided by an attitude of care, responsibility and respect for living creatures. Pain inflicted by practices such as marking must be kept to a minimum. Stress must be minimized. Living conditions must consider the natural needs of the animal, such as

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those for free movement, food, water, shelter and shade. Consideration must be given to their specific behaviour patterns.

- 2.4 Livestock must be fed on foodstuffs produced in compliance with this Standard except in situations covered by paragraph 7.3 of Section 7.
- 2.5 Livestock should be bred on the property. Purchases of livestock from outside sources other than from certified FGP, certified Organic or certified Biodynamic properties are restricted to the conversion period. After this period, increases of livestock are restricted to breeding stock, with the exception of:
 - Ducks, geese and poultry, which may be one week old before being brought into the Analog Forest system.
 - Fish, amphibians or reptiles, which can be brought in as eggs or larvae.
- 2.6 Diseases and parasites in livestock must be controlled by enhancing the natural resistance through balanced, healthy nutrition and selective breeding. Animals must not be treated or fed with any non-approved chemicals, vitamins or growth promotants.
- 2.7 When native fauna is used as livestock, a concomitant restocking and habitat-enhancing program must be in place.

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ANNEX II

A. Management Inputs

1. A Forest Garden emerging from the application of the principles of Analog Forestry* will operate as a high-value biomass sink within a production system that is as closed as possible to external inputs, but as open as possible for genetic flow. Inputs from the outside must be kept to an absolute minimum and used on the basis of need only. Although the inputs listed below are not meant for continuous use, they may be used in situations where the natural balance of the system needs to be restored or maintained, or in situations where the natural productivity needs to be enhanced to achieve a sustainable production unit.
2. Good design and management are paramount. All inputs must be used, in conjunction with an accredited certification organization, only on the basis of need. It must not be used to support poorly designed or badly managed systems.
3. Sufficient organic material should be returned to the soil to increase the levels of soil organic carbon where increment is possible, or to maintain levels of soil organic carbon where maximal levels have been reached.
4. Conservation and recycling of nutrients is a major feature of any forest system. The use of mineral fertilizers should be always is seen as a supplement to recycling, not as a replacement.
5. All biomass input must be sourced from certified or certifiable sources, except in emergency situations covered in paragraph 7.3 in Section 7.
6. Feed or composting additives of mineral, plant or biological source may be imported to the level of 5% of total inputs; they may be in the form of:
 - Kelp
 - Molasses
 - Minerals
 - Salt
 - Microbial sprays
 - Botanic teas
 - Additives
7. It is generally necessary to adequately heat compost biological material by natural means and it is essential for any material brought in from non-certified sources.
8. Materials which may contain excess concentration of potential contaminants such as heavy metals should not be used. Where suspected materials are used repeatedly or in large volumes, they should be analysed and their acceptability approved by accredited

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- certifier.
9. The following lists are subject to review and inclusion of a material does not imply that it is safe in all circumstances. Any additions or changes to the lists will be made only after it has been demonstrated that they meet with the requirements of this Standard.
 10. Where inputs are required they should be used with care and with the knowledge that even permitted inputs can be subject to misuse and may alter the ecosystem or farm.

B. Permitted Materials for use in Soil Fertilizing and Soil Conditioning

For soil management and improving fertility the following materials are permitted:

- Composts from organic farm or household refuse
- Composts from plant residues
- Peat
- Coconut Fibre Dust
- Wood Ash
- Sawdust, wood waste, bark or rice hull from untreated sources
- Organic by products from food and textile industries
- Straw
- Slurry or urine
- Heat composted animal manures*
- Blood and bone, fish meal, hoof and horn meal, or other waste products from fish or animal processing *
- Seaweed or seaweed meal *
- Bio-Dynamic preparations 500-507
- Approved microbial or biological preparations
- Massive Soil Inoculation (MSI) from identified sources
- Naturally occurring biological organisms (ie.worms) but excluding products from • recombinant DNA technology
- Fish products
- Homeopathic preparations
- Ayurvedic and other traditional plant based preparations
- Basic slag
- Dolomite and Lime
- Gypsum (Calcium sulphate) from a natural source
- Calcined or rock phosphate
- Rock Potash and sulphate potash
- Crushed mineral bearing rock
- Stone meal
- Clay
- Trace minerals (includes materials such as Borax, Epsom salts, but not synthetically chelated elements). Natural chelates such as lingo sulphates are acceptable, as are those using natural chelating agents such as citric,

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malic, tartaric and other di- and tri- acids.

- Radioactive rock ^

Note: The repeated use of any product has the potential to introduce unwanted residues and contaminants. Heavy or repeated use of any products should be supervised by an accredited certifying organization and based on an assessment of need and with knowledge of chemical analyses.

*These products must be free of additives that are prohibited substances, such as artificial fertilizers.

^ Must be applied as active compost or re-mineralizing rock flour and must not exceed the radiation levels of native basaltic or igneous rock.

C. Approved Materials for Plant Pest and Disease Control

- The reliance on substances rather than management practices for the controlling of pests and diseases is not in accordance with Analog Forestry principles. Caution needs to be exercised even when using products derived from natural sources, as they are not necessarily non-toxic. Some of the approved materials are selected for their short life in the environment and may not always be of low toxicity.
- Where applicable, the effect of bio-concentration should be examined in respect to each ecosystem.
- The following substances are permitted for use in the management of a Forest Garden:
 - Pyrethrum* extracted from *Chrysanthemum cinerarifolium*, without piperonyl butoxide
 - Rotenone extracted from *Derris elliptica*
 - Quassia extracted from *Quassia amara*
 - Ryana extracted from *Ryania speciosa*
 - Neem oil and extracts from *Adzirahta indica*
 - Capsaicin extracted from *Capsicum* sp.
 - Grapefruit seed extract
 - Natural plant extracts, excluding tobacco, obtained by infusion and made by the farmer, without additional concentration such as garlic extract etc., and used as a repellent or pest/disease control.
 - Essential oils
 - Vinegar
 - Fermented sprays
 - Propolis

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- Homeopathic preparations
- Seaweed, Seaweed meal, Seaweed extracts, sea salts and salty water
- Biological controls (naturally occurring organisms and approved cultured
- Organisms such as *Bacillus thuringiensis*)
- Pheromones
- Granulose virus preparations
- Light mineral oils
- Diatomaceous earth in non heat-treated form
- Wood ash
- Stone meal
- Potassium soap (soft soap)
- Sodium silicate
- Sodium bicarbonate
- Sulphur in a wettable or dry form
- Copper (Hydroxide is the preferred form)
- Bordeaux mixture, Burgundy mixture and other forms of Copper
- Potassium permanganate
- Carbon Dioxide and Nitrogen gas
- Metaldehyde baits in traps or enclosed from the environment

Note: Caution needs to be exercised with respect to wetting agents that may be contained in some of commercial formulations of the above products. Acceptable wetting agents include seaweed products and vegetable oils such as coconut oil.

D. Approved Materials for Animal Pest and Disease Control

- The maintenance of a healthy livestock within an Analog Forest are based on the provision of conditions for healthy life by providing all of the nutritional and health promoting substances from a diverse ecosystem at trophic levels pertaining to that livestock. The social needs of the animals must also be addressed.
- The following substances are permitted for use in the management of livestock within a Forest Garden:
 - Pyrethrum* extracted from *Chrysanthemum cinerarifolium*, without piperonyl butoxide
 - Rotenone extracted from *Derris elliptica*
 - Quassia extracted from *Quassia amara*
 - Ryana extracted from *Ryania speciosa*
 - Neem oil and extracts from *Adzirahta indica*
 - Garlic oil, Garlic extract or crushed garlic

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- Natural plant extracts obtained by infusion
- Seaweed, Seaweed meal, Seaweed extracts
- Homeopathic preparations
- Ayurvedic or other traditional preparations as long as they do not violate the aims stated in Section 3.1
- Essential oils
- Cider Vinegar
- Tallow
- Nettle and other herbal powders
- Diatomaceous earth in non heat-treated form
- Sodium bicarbonate
- Sulphur
- Copper sulphate
- Zinc sulphate
- Selenium and other trace elements
- Vaccines (may be used only for a specific disease which is known to exist on the organic farm or on neighbouring farms and which threatens livestock health and which cannot be effectively controlled by other management practices.)

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ANNEX III

Indicators :

In the application of Analog Forestry, the improvement of the production environment and development of biodiversity are two critical goals. Acknowledging the principle that 'Nature is a valid reflection of management', the operator is encouraged to pay attention to the variables that follow. Indicators measured at the initial inspection will provide the baselines against which all future inspections will be evaluated.

1. Environmental:

Operators must have an environmental policy with a responsible person for the implementation of the policy

Environmental indicators refer to the physical representation or measures of physical or chemical variables on any farm.

1.1 Soil

1.1.1 Compaction/bulk density

1.1.2 Organic matter

1.1.3 Rooting density

1.2 Water

1.2.1 Chemistry

1.2.2 Clarity

1.2.3 Visible pollutants

1.3 Vegetation

1.3.1 % cover: (a) early seral (b) late seral (c) mature

1.3.2 Corridors: (a) natural (b) designed

Wastewater from wet processing units:

- Must be analysed periodically at normal operating capacity and the results documented.
- Must have procedures to minimise waste and discharge.
- Must have procedures for monitoring waste, discharge and correct disposal.
- Must have documentation of training in the conservation of water and energy.

2. Species

Species indicators refer to specific organisms that have a known significance in terms of sensitivity to disturbance or chemical inputs.

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2.1 Soil

2.1.1 Macro organisms (species, significance)

2.2 Vegetation (species, significance)

2.2.1 Woody

2.2.2 Non woody

3 Invertebrates (species, significance)

4 Vertebrates (species, significance)

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ANNEX IV

Social Criteria

In developing a fair and equitable response to the pattern of trade, this Standard addresses participants along the market chain. The producers have individual and social responsibility by his/her family and by his/her community. The exporter has a responsibility in ensuring a fair share of the profitability is repatriated to the production area. The importer has a responsibility by the producers to be transparent on pricing and by maintain auditable records to ensure full customer confidence.

1. For individual smallholders

- 1.1 The operator's rights must be recognized at national or local levels on all land under this Standard. The holding size is usually small and the holding is managed without the use of regular outside labour.
- 1.2 No land managed by the family shall use child labour to the detriment of the education and development of the child.
- 1.3 No land under this Standard may be sub-leased or contracted to other operators.
- 1.4 There will be a demonstrable investment in family infrastructure and education.
- 1.5 The fossil energy input to crop output must not exceed 40%.
- 1.6 In cases where regular outside labour is used, minimum wage, provident fund requirement, or workplace insurance must be provided.

2. For corporate smallholders

- 2.1 All land administered by a cooperative or corporate structure must have a ratified policy of FGP implementation in its lands under certification.
- 2.2 Capacity building and education of members must be an institutional goal.
- 2.3 An Internal Control System (ICS) should be in place.
- 2.4 A transparent decision-making process in prioritizing community needs to be addressed through premium payments.
- 2.5 Child, forced or bonded labour will be disallowed.
Workers are not required to lodge "deposits" or their identity papers with their employer.
Workers are free to leave their employer after reasonable notice.
- 2.6 The fossil energy input to crop output must not exceed 40%.

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3. For large corporate landholders

3.1 A program of Corporate Social Responsibility (CSR) should be in place.

3.2 A program of collective bargaining must be in place.

3.3 Child labour, forced or bonded labour will be disallowed.

Workers are not required to lodge "deposits" or their identity papers with their landholder.

Workers are free to leave their landholder after reasonable notice.

3.4 Working hours comply with national laws and benchmark industry standards, whichever affords greater protection.

3.5 The fossil energy input to crop output must not exceed 40%.

4. The activity must assist in developing the community to become more aware of itself and assist in developing community health, nutrition and education.

Working hours comply with national laws and benchmark industry standards, whichever affords greater protection.

Overtime shall be voluntary, shall not exceed 12 hours per week, shall not be demanded on a regular basis and is compensated at a premium rate.

Physical abuse or discipline, the threat of physical abuse, sexual or other harassment and verbal abuse or other forms of intimidation is prohibited.

To every extent possible work performed must be on the basis of recognised employment relationship established through national law and practice.

5. For Processing units:

A safe and hygienic working environment shall be provided, bearing in mind the prevailing knowledge of the industry and of any specific hazards.

Access to clean toilet facilities and to potable water, and, if appropriate, to rest areas, food consuming areas and sanitary facilities for food storage shall be provided.

Accommodation, where provided, shall be clean, safe, and meet the basic needs of the workers.

Physical abuse or discipline, the threat of physical abuse, sexual or other harassment and verbal abuse or other forms of intimidation is prohibited.

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Working hours comply with national laws and benchmark industry standards, whichever affords greater protection.

Overtime shall be voluntary, shall not exceed 12 hours per week, shall not be demanded on a regular basis and is compensated at a premium rate.

To every extent possible work performed must be on the basis of recognised employment relationship established through national law and practice.

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ANNEX V

Minimum Inspection Requirements and Precautionary Measures Under the Inspection System

A. Farms

1. All production on land under certification must comply with the inspection system given in Section 5 of this Standard.
2. Production and storage of certified produce must take place in production and storage locations, which are clearly separate from those not producing in accordance with the requirements of this Standard.
3. Products not covered by this Standard must be stored separately and both types of products must be clearly identified.
4. Processing and/or packaging premises may handle produce which is not in compliance with this Standard provided such produce is handled quite separately, is clearly identified and documented, and all equipment is pre-cleaned to the satisfaction of the accredited certification organization.
5. When applying for certification to an accredited certification organization, an applicant must provide all the information required under paragraph 4.6 of Section 4.
6. Subsequent to a questionnaire/application being satisfactorily completed and lodged, an accredited certification organization will arrange for an inspection of the property.
7. During this inspection, the assessor is required:
 - i. To review the Whole Farm Plan and questionnaire with the producer, noting misunderstandings, discrepancies, etc.
 - ii. Conduct a visual survey of landscape, crop and biodiversity indicators.
 - iii. Conduct a physical survey of the soil and water.
 - iv. Examine livestock.
 - v. Check sheds and stores for conformity.
 - vi. Check farm records (derogation: this could be oral if it is presented by the community in unlettered communities).
 - vii. Prepare a detailed inspection report and recommendation.
8. The inspection report must specify the date of the last application to the land concerned of any products whose use is not compatible with this Standard.

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9. The approved certifying organization must obtain an undertaking by the producer that, if granted certification, operations will be carried out in accordance with this Standard.
10. Written and/or documentary accounts must be kept to enable an accredited certifying organization to trace the origin, nature and quantities of all raw materials brought in and the use of such materials. Records must also be kept of the nature, quantities and consigners of certified Forest Garden Products.
11. Apart from unannounced inspection visits, an accredited certifying organization must make full physical inspections on a regular basis in accordance with its rules of operation. Where the use of unauthorised substances is suspected, samples must be taken and analyses arranged with an appropriately accredited laboratory. An inspection report should be drawn up after each visit.
12. The producer must give the inspector free access to the production area and storage premises as well as to accounts and relevant supporting documents. The inspector must be provided with any information deemed necessary for the purposes of inspection.
13. Farms claiming carbon sequestration or fossil carbon reduction must have a baseline established by the inspector (see Annex V) and cannot claim any gains until established at a subsequent inspection.

B. Sampling

1. If chemical residue sampling is required, initial chemical residue testing could be restricted to Organochlorine (OC), Organophosphate (OP) and heavy metal residues in products. Testing programs must be developed particularly when there are specific indications that residues may exist from other agricultural and environmental sources.
2. Certified products should be randomly tested based on a 5% of farms per annum. In addition, a testing program should be carried out where there is any basis for concern.
3. Where an ICS that includes random sampling exists, submission of the ICS report can be accepted in lieu of 2.

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4. Where Carbon is to be certified: the models for above-ground carbon as detailed in Annex V and the model for soil carbon as detailed in Annex V should be adopted for sampling.

C. Record Keeping

1. Certification requires detailed documentation in order, unless derogation is obtained on the basis of weak capacity to provide a detailed audit trail of all processes and inputs in order to verify to the consumer that the produce meets the claims of the Forest Garden Products label.
2. Written records are required for all materials brought onto the farm. These records must include data on the type of material, source, ingredients and post-delivery treatment.
3. All records must be maintained and be kept on file for at least two years even after the crop has been sold.

Where relevant, records must be kept for the following :

- Materials from off-farm sources including seed, fertilizer, manure, soil amendments, sprays, etc.
- Details of fertilizer and spray applications.
- Details of veterinary treatments and fodder sources.
- Details of forest establishment procedure.
- Details of tree species and non-tree species planted.
- Details of biodiversity enhancement.
- Details of carbon baselines and signed certification confirming levels.
- For fossil energy use (Fossil Carbon Footprint):
 - (a) details of fossil energy used in production and transport,
 - (b) details of fossil energy used in production and processing,
 - (c) details of fossil energy used in the production of farm inputs,
 - (d) details and quantities of Cement brought into the farm.
- Sales data.

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D. Processing and Packaging of Forest Garden Product

1. When the inspection arrangements are first implemented, the operator and an approved certifying organization must draw up :
 - A full description of the premises, showing the facilities used for the processing, packaging and storage of agricultural products.
 - All practical measures to be taken to ensure compliance with this Standard.
2. These details and measures concerned must be contained in an inspection report, countersigned by the operator. In addition the report must include:
 - a. An undertaking to perform the operations in such a way as to be in compliance with Section 4, and
 - b. To accept, in the even of infringements, the implementation of measures referred to in paragraph 5.2 of Section 5.
3. Where an operator runs several production units, any products from agricultural holdings or processing premises which are not subject to inspection may not be processed, packaged or stored in the approved premises in a manner which may cause any infringement of this Standard.
4. Written accounts and documents must be kept to enable an accredited certification organization to trace:
 - i. The origin, nature and quantities of agricultural products as specified in Section 1 which have been delivered to the premises.
 - ii. The nature, quantities and consignees of products which have left the premises.
 - iii. Any other information, such as the origin, nature and quantities of ingredients, additives and manufacturing aids delivered to the premises.
5. The composition of the ingredients of processed products as required by an accredited certification organization for the purposes of proper inspection of the operations.
6. Where products not covered by Section I are also processed, packaged or stored in the premises concerned:
 - i. The premises must have separate areas for storage of

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- products as referred to in Section I before and after the operations concerning them.
- ii. Operations must be carried out continuously until the complete run has been dealt with and separated from similar operations performed on products covered by Section I.
 - iii. All necessary measures must be taken to ensure identification of lots and to avoid mixtures with products not obtained in accordance of this Standard.
7. Apart from unannounced inspection visits, an accredited certifying organization must make full physical inspections on a regular basis, in accordance with its rulers of operation. Where the use of unauthorised substances are suspected, samples must be taken and analyses arranged. An inspection report must be drawn up after each visit.
 8. In cases of unannounced inspection visits, the operator must give the accredited certifying organization access to the premises as well as to the written accounts and relevant supporting documents. An accredited certifying must be provided with any information necessary for the purposes of the inspection.
 9. Products covered by Section I of this Standard, which are not in final packaging, may be transported to other premises only in appropriate packaging or containers, which are adequately labelled and identified to include:
 - i. The name and address of the person or organization responsible for the production or preparation of the product.
 - ii. The name of the product.
 - iii. An indication specifying that the product is covered by the regular inspection arrangements of an accredited certifying organization.
 10. Products labelled under the provisions of Section 6 may only contain food additives, processing aids, or be subjected to those substances to be developed.

E. Sanctions

- An accredited certifying organization must take necessary action if a producer or operator is found to contravene any provisions of this Standard. Refer also to paragraph 5.2(b) of Section 5.

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ANNEX VI

Forest Garden Farm Plan (FGFP)

1. The Forest Garden Farm Plan (FGFP) is a detailed map that records the existing physical and ecological structure of the property. It also serves to provide a clear work plan for the establishment of a Forest Garden. Although a plan could begin as rudimentary, it is expected that in all cases the FGFP will demonstrate increasing sophistication and full conformity over a five-year time horizon. A completed FGFP must have the following features at a minimum:

1. Existing drainage patterns
2. Cropping pattern
3. Existing buildings
4. Existing roadways
5. Existing vegetation patterns
6. Ecological valuation
7. AF design
8. Implementation plan
9. By way of derogation to above requirements, only (1), (2) and (3) need to be submitted by unlettered farmers or indigenous peoples until their capacity to produce a FGFP or Area Treatment Plan (ATP) has been developed. An accredited certifier should set the time period.

2. All FGFP's submitted must have an Analog Forest design for the tree-dominated component based on the structure and function of the original vegetation.

3. All FGFP's will incorporate a Total Ecosystem Management (TEM) approach.

4. All FGFP's must address the flow systems and corridors connecting it to other aspects of the landscape.

5. Baselines can be measured by the operator, but need to be verified by the inspector.

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ANNEX VII

Biodiversity and Landscape

Analog Forestry establishes and enhances the natural landscape. The relation of the FGFP (Annex VI) to its landscape must be such that :

- 1.1 The landscape should be maintained such that the stability of the physical and biodiversity aspects are not eroded.
- 1.2 The ability of biodiversity elements to move across a landscape should not be reduced or degraded.
- 1.3 The input of toxins and fertilizer salts from neighbouring landscapes should be controlled by design.
- 1.4 The functionality of flow elements (water, soil and air) across a landscape should be maintained.
- 1.5 Anthropogenic elements such as roadways, drains, buildings, etc. should not contribute to the erosion action on the landscape.
- 1.6 The total biomass on a landscape should be conserved or built up.

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ANNEX VIII

Soil and Sequestered Carbon (Voluntary Standard)

1. Soil is seen to be comprised of four basic units: minerals, air, water and biomass. The biomass in the soil represents an ecosystem that is often as complex as the terrestrial ecosystems above the ground. Thus, similar attention to the development and maturity of the soil ecosystem is seen to be important in creating Analog Forestry design. As noted by Krasil'nikov (1958), 'the principal property of soil fertility is determined by biological factors, mainly by microorganisms. The development of life in the soil endows it with the property of fertility.' Its critical importance to productivity is illustrated by Albrecht (1938), who states that "soil organic matter is one of our most important national resources; its unwise exploitation has been devastating; and it must be given its proper rank in any conservation policy as one of the major factors affecting the levels of crop production in the future.' Further, soil carbon has been identified as a very significant sequestered pool of atmospheric carbon (Senanayake 1993). Therefore, the operator shall:

1. Measure the base load of soil carbon at initiation of program*.
2. Establish a monitoring program.
3. Identify indicator organisms of system maturity.
4. Establish a monitoring program for soil indicators.
5. Establish base load of terrestrial carbon.
6. Monitor the increment of sequestered carbon annually.

2. The output from growing trees in terms of sequestering carbon can be stated as Wt . W or the carbon sequestered +TLR where:

- T = Timber, trunk and branch material over y cm in diameter,
L = Leaves, bark and stems under y cm in diameter,
R = Roots and all other underground parts.

In addition to producing the photosynthetic products listed above, a growing tree also contributes to the creation of soil organic matter. As a forest product, soil also has great value as a carbon sink. The process of the biochemical distillation of photosynthetic products can keep atmospheric carbon dioxide tied to or sequestered by the biological system for periods exceeding 4000 years. Approximately 16% of the long-lived fraction identified as 'old carbon' can have lifetimes from 5700 - 15,000 years. The role of soil in sequestering, or tying up, atmospheric carbon dioxide needs to be recognized. An evaluation of the sequestering potential of various forest ecosystems suggests that forest soils contain a large proportion of the carbon pool. These long-lived compounds are a

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product of the bio-chemical distillation of photosynthetic products and tie up about 20-30% of the organic matter that reaches the soil from the above-ground environment. This long-lived matter (LSc) component can be represented as a ratio of plant production.

Where the sum total of the plant production is its total biomass (Wt), the ratio LSc/Wt will vary according to the efficiency of a particular soil to sequester carbon into the long-lived pool and the end-use of the forest. In the case of tree crops, the contribution to the soil will only be from the roots, leaves and branches, such that $Wt = L+R$, as the timber is expected to be removed from site or used for an anthropocentric purpose.

The variable (T), representing timber, will have a sequestering value equal to the time of growth and biomass attained. At harvest, the value of the clear wood as a carbon sink will depend on its end use. Therefore, (T) must be described with a multiplying factor dependent on the durability and end use of the wood. For instance:

End use	Firewood	Pulpwood	Chipwood	Constr. Timber
Multiplier (z)	.05	1.0	1.75	2.5

The value Tz can then be added to LSc to give some approximation of the carbon that was sequestered into the long-term pools, so that:

$$Tz + LSc = p$$

Similar calculations can be made of the short and medium term pools.

a). To obtain the biomass density of a forest based on existing volume data.

Primary needs:

Access the Commercial Timber Volume (this is obtained from the company or state permit office). Work out the oven-dry biomass of the CTV by obtaining the oven-dry biomass of the species being taken and multiplying it by the inventoried volume.

Next, the site is visited; in a practical number of samples, at least over three per ecosystem, the VOB is measured. VOB means the inventoried volume over bark-free bole (bole is the trunk section from stump or buttress to crown point or first main branch). It is expressed in t/ha; thus a minimum of a Hectare must constitute a sample.

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The inventoried volume in a VOB must include ALL trees whether presently commercial or not, with a minimum diameter of 10 cm at breast height or at buttress if this is higher.

Biomass density can now be calculated from the VOB/ha by first estimating the biomass of the inventoried volume and by applying a multiplier that takes into account the biomass of the other above-ground components.

Above-ground biomass density (t/ha) = VOB*WD *BEF

Here: WD = volume – weighted average wood density (t of oven-dry biomass per m³ green volume).

BEF = biomass expansion factor (ratio of above-ground oven-dry biomass of trees to oven-dry biomass of inventoried volume); this is the oven-dry biomass of all trees whether presently commercial or not, with a minimum diameter at 10 cm at breast height (DBH) or at buttress if this is higher.

WD = The volume-weighted average wood density. This is the oven-dry mass per unit of green volume (either in tond/m³ or grams/cm³).

Examples of application:

In a forest with a VOB = 300m³/ha and a WD of 0.65 t/m³

Step 1: Calculate biomass of VOB = 300m³/ha x 0.65 t/m³ = 194 t/ha

Step 2: Calculate the BEF = VOB/CTV (usually about 1.74 for CTV of over 190t/ha)

Step 3: Calculate above-ground biomass density = 194 x 1.74 = 338 t/ha

Step 4: Calculate total biomass (TB); accumulation assumed to be equal to 1.6 times stemwood accumulation = 338*1.6 = 540.8 t/ha

Step 5: Calculate the total carbon content: CT = TB/4 or 540/4 = 135.2 t Carbon

* VOB means the inventoried volume over bark free bole (bole is the trunk section from stump or buttress to crown point or first main branch). It is expressed in t/ha; thus a minimum of a hectare must constitute a sample. If the area is smaller than a hectare, the total area must be sampled. The inventoried volume in a VOB must include ALL trees whether presently commercial or not, with a minimum diameter of 10 cm at breast height or at buttress if this is higher.

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b) To obtain the soil carbon level :

- 1) Design a sampling procedure based on the contours of the land.
- 2) Collect a minimum of twenty samples per hectare*.
- 3) Pool samples: into 1 pool if the slope is below 15%, 2 pools if the slope is above 15% (one for upper contour one for lower contour).
- 4) Draw a 150 cc sample from each pool.
- 5) Test for unit weight of carbon in 10 cc of each sample (CV).
- 6) Calculate using a formula $CV \times 15 \times 100,000$ to obtain weight per hectare.

* For measuring soil carbon take a sample of soil from the upper 15 cms of the land being tested from a 10cm area.

3. Soil carbon has been identified as a very significant sequestered pool of atmospheric carbon. Therefore the operator shall:

1. Measure the base load of soil carbon at initiation of program.
2. Establish a monitoring program.
3. Sample at the same points or design when monitoring.

When considering time as a value variable:

The total carbon content (CT) representing timber will have a sequestering value equal to the time of growth and biomass attained. At harvest, the value of the clear wood as a carbon sink will depend on its end use. Therefore (VOB) must be described with a multiplying factor dependent on the durability and end use of the wood. For instance:

End use	Firewood	Pulpwood	Chipwood	Constr. Timber
Multiplier (z)	.05	1.0	1.75	2.5

The value $VOB \times z$ can give some approximation of the carbon that will be sequestered into the long-, short- and medium-term pools.

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c) To obtain the fossil carbon footprint :

a) Compute fossil energy used in production and transport.

This will entail the computation of the volume of carbon dioxide generated from the total consumption of petrol, diesel and heating oil used in the field production process and in transport of the product, both as processed and unprocessed. The computation will take into account transport used by workers and transportation by management.

(b) Details of fossil energy used in processing.

This will entail the computation of the volume of carbon dioxide generated from the total consumption of petrol, diesel and heating oil used in processing the product. All factory and packaging activity requiring fossil energy will be recorded under this line.

(c) Details of fossil energy used in the production of farm inputs.

This refers to the computation of the volume of carbon dioxide generated from the total consumption of petrol, diesel and heating oil used in the production of farm input. The production of compost, transport of composting ingredients, vermiculture operations, livestock operations, etc., will be evaluated under this line.

(d) Details and quantities of cement brought into the farm.

Details of the volumes of cement brought into the farm for construction or other farm infrastructure activities will be recorded under this line.

The computation of the CO₂ emitted /unit will be as follows :

	Unit	CO₂
Petrol	1 liter	2.3 kg
Diesel	1 liter	2.7 kg
Oil (heating)	1 liter	3 kg
Cement	1 Tonne	.97 – 1.1 tonnes

Convert kg carbon dioxide in kg carbon by multiplying by a factor of 0.27.
(i.e. 1000 kg CO₂ equals 270 kg carbon)

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Annex IX: Negative List of Pesticides (WHO 1a+1b)

World Health Organisation classifications

The WHO classification measures acute toxicity. FAO recommends that WHO 1a and 1b pesticides should not be used in developing countries, and if possible, class II should also be avoided. Note that a 'weaker' formulation will move these active ingredients into a lower hazard classification.

WHO 1a	WHO 1b	
Extremely Hazardous	Highly Hazardous	
Aldicarb	3-chloro-1,2-propanediol	Lead arsenate
Brodifacoum	Acrolein	Mecarbam
Bromadiolone	Allyl alcohol	Mercuric oxide
Bromethalin	Azinphos ethyl	Methamidophos
Calcium cyanide	Azinphos-methyl	Methidathion
Captafol	Blasticidin-S	Methiocarb
Chlorethoxyfos	Butocarboxim	Methomyl
Chlormephos	Butoxycarboxim	Monocrotophos
Chlorophacinone	Cadusafos	Nicotine
Difenacoum	Calcium arsenate	Omethoate
Difethialone	Carbofuran	Oxamyl
Diphacinone	Chlorfenvinphos	Oxydemeton methyl
Disulfoton	Coumaphos	Paris green
EPN	Coumatetralyl	Penthachlorophenol
Ethoprophos	Demeton-s-methyl	Pindone
Flocoumafen	Dichlorvos	Pirimiphos ethyl
Fonofos	Dicrotophos	Propaphos
Hexachlorobenzene	Dinoterb	Propetamphos
Mercuric chloride	DNOC	Sodium arsenite
Mevinphos	Edifenphos	Sodium cyanide
Parathion	Ethiofencarb	Strychnine
Parathion methyl	Famphur	Tefluthrin
Phenylmercury acetate	Fenamiphos	Thallium sulfate
Phorate	Flucythrinate	Thiofanox

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Phosphamidon	Fluoroacetamide	Thiometon
Sodium Fluoroacetate	Formetanate	Triazophos
Sulfotep	Furathiocarb	Vamidotion
Tebupirimfos	Heptenophos	Warfarin
Terbufos	Isazofos	Zeta cypermethrin
	Isofenphos	Zinc phosphide
	Isoxathion	

Reference: The WHO Recommended Classification of Pesticides by Hazard, 2002-2002

List of Pesticides and Chemicals with Carcinogenic potential:

- 1) Acetochlor
- 2) Acifluorfen sodium
- 3) Acrylonitrile
- 4) Alachlor
- 5) Aldrin
- 6) Amitrole
- 7) Aramite
- 8) Arsenic compounds
- 9) Azobenzene
- 10) Baygon/Propoxur
- 11) Benzene
- 12) Bis(chlorethyl)ether (BCEE)
- 13) Butachlor (Machete)
- 14) Cacodylic acid
- 15) Cadmium
- 16) Captafol
- 17) Captan
- 18) Carbontetrachloride
- 19) Chlordane
- 20) Chlordimeform
- 21) p – Chloroaniline
- 22) Chloroform
- 23) Chlorothalonil
- 24) Chromic Acid
- 25) Sodiumdichromate
- 26) Clodinafop-propargyl
- 27) Cocamide Diethanolamine
- 28) Creosote
- 29) Cyproconazole
- 30) Daminozide (Alar)
- 31) DDD
- 32) DDE
- 33) DDT
- 34) Di(2-ethylhexyl)phthalate
- 35) Dibromochloropropane (DBCP)
- 36) 1,2 – Dibromoethane

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- 37) 1,2 – Dichloroethane
- 38) Dichloromethane
- 39) 1,3 – Dichloropropene (Telone II)
- 40) Diclofop-methyl (Hoelon)
- 41) Dicrotophos (Bidrin)
- 42) Dieldrin
- 43) Diuron
- 44) Epichlorhydrin
- 45) Ethoprop (Ethoprophos)
- 46) Ethylene oxide
- 47) Ethylene thiourea (ETU)
- 48) Febram
- 49) Fenoxycarb
- 50) Fluthiacet-methyl (Action)
- 51) Folpet
- 52) Formaldehyde
- 53) Furmecyclox (Xyligen B)
- 54) Haloxyfop-methyl(verdict)
- 55) Heptachlor
- 56) Heptachlorepoxyde
- 57) Hexachlorobenzene (HCB)
- 58) Hexachlorocyclohexane
- 59) Imazalil
- 60) Iprodione (Glycophene)
- 61) Iprovalicarb
- 62) Isoxaflutole
- 63) Kresoxim-methyl
- 64) Lactofen (Cobra)
- 65) Lindane
- 66) Malathion
- 67) Mancozeb
- 68) Maneb
- 69) Metam sodium
- 70) Methylisothiocyanate
- 71) Metiram
- 72) MON 13900 (Furilazole)
- 73) MON 4660
- 74) Nitrapyrin
- 75) Orthophenylphenol & Na-Salt
- 76) Oxadiazon
- 77) Oxythioquinox (Morestan)
- 78) Pentachlorophenol
- 79) Phosmet (Imidan)
- 80) Polychlorinated biphenyls
- 81) Procymidone (Sumilex)
- 82) Pronamide (Karb)
- 83) Propachlor
- 84) Propanil
- 85) Propargite (Omite)
- 86) Propylene oxide
- 87) Pymetrozine
- 88) Pyrethrins
- 89) Sulfosulfuron (MON 31500)
- 90) Terrazole
- 91) Tetraconazole
- 92) Thiabendazole
- 93) Thiamethoxam

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- 94) Thiodicarb (Larvin)
- 95) Thiophanate-methyl
- 96) Toxaphene (Camphechlor)
- 97) Tribufos (Tribuphos / DEF)
- 98) Trichlorfon (Trichlorphon)
- 99) 2,4,6 – Trichlorophenol
- 100) Triphenyltin hydroxide
- 101) UDMH
- 102) Ziram
- 103) Zineb

Wildlife Toxicity of Pesticides :

A) Toxic to Fish

Acetochlor, Alachlor, Aldicarb, Aldrin, Allethrin, Amitraz, Azamethiphos, Azinphos-methyl, Azocyclotin, BAP, Benzfuracarb, Bifenox, Bifenthrin, Bromadiolone, Bromophos, Bromophos-methyl, Bromoxynil, Butylate, Cadusafos, Captafol, Captan, Chlordane, Chlorethoxyfos, Chlorfenvinphos, Chlormephos, Chloropicrin, Chlorothalonil, Chlorpyrifos, Cloethocarb, Copper Oxychloride, Copper Oxide, Cyanofenphos, Cyhalothrin, Cypermethrin, Dazomet, DDT, Diazinon, Dichlofenthion, Dichlofluanid, Dichlorvos, Diclobutrazol, Diclofop-methyl, Dicofol, Dieldrin, Dienochlor, Difenconazole, Dinobuton, Dinocap, Dinosep, Dinoterp, Diphenylamine, Dodine, Drazoxolon, Edifenphos, Endosulfan, Endothal, EPTC, Esfenvalerate, Ethion, Ethoprop, Fenbutatin-oxide, Fenoxaprop-ethyl, Fenciclonil, Fenpropidin, Fensulfothion, Fenvalerate, Fludioxonil, Fluvalinate, Folpet, Fonofos, Heptenophos, Jodfenphos, Malathion, Maneb, Mephosfolan, Metam-Sodium, Methasulfocarb, Methomyl, Methylisothiocyanate, Monocrotophos, Naled, Niclosamide, Nitrofen, Oxadiazon, Oxamyl, Oxyfluorfen, Parathion, Parathion-methyl, PCNB, Pendimethalin, Permethrin, Phosalone, Phosmet, Pirimiphos-methyl, Promecarb, Prometryn, Propachlor, Propargite, Propiconazole, Prothiophos, Pyrazophos, Quizalofop-ethyl, Resmethrin, Rotenone, Sodium arsenite, Tebufenpyrad, Tefluthrin, Terbutryn, Tetramethrin, Thiophanate-methyl, Thiram, Thiodicarb, Tralomethrin, Triazophos, Tribufos, Triflumizole, Tolyfluanid, Zineb.

B) Toxic to Birds

Aldicarb, Aldoxycarb, Aldrin, Azamethiphos, Azinphos-ethyl, Cadusafos, Carbofuran, Chlorethoxyfos, Chlorfenvinphos, Chlorpyrifos, Demeton-S-methyl, Diazinon, Dicamba, Dichlorvos, Dimethoate, Dinobuton, Dinoseb, Diphacione, Drazoxolon, Endosulfan, EPN, Ethoprop, Fensulfothion, Fonofos, Formetanate, Isazofos, Lindane, Metaldehyde, Methamidophos, Mevinphos, Monocrotophos, Oxydisulfoton, Parathion, Parathion-methyl, Phorate, Phosphamidon, Phoxim, Pirimiphos-methyl, Propaphos, Sodium arsenite, Thiodicarb.

C) Toxic to Bees

Abamectin, Acephate, Azinphos-ethyl, Bacillus thuringiensis BT, BAP, Bifenthrin, Bromophos-ethyl, Carbaryl, Carbosulfan, Chlorfenvinphos, Chlormephos, Chlorpyrifos, Cloethocarb, Copper sulfate, Cypermethrin, DDVP, Deltamethrin, Demeton, Demeton-S-methyl, Diazinon, Dichlorvos, Dicrotophos, Dieldrin, Dimethoate, Dinobuton, Dinoseb, Dinoterb, DNOC, Esfenvalerate, Ethron,

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Etrimfos, Fenitrothion, Fenpropathrin, Fensulfothion, Fenvalerate, Fonofos, Heptachlor, Heptenophos, Jodfenphos, Lindane, Malathion, Mephosfolan, methamidophos, Methidathion, Methomyl, Mexacarbate, Monocrotophos, Naled, Omethoate, Oxadiazon, Oxamyl, Oxydemeton-methyl, Oxydisulfoton, Parathion, Parathion-methyl, Permethrin, Phenothrine, Phenthoate, Phosmet, Phosphamidon, Pirimiphos-methyl, Promecarb, Pyrazophos, Quinalphos, Resmethrin, Tetrachlorvinphos, Tetramethrin, Thiometon, Tralomethrin, Triaziphos, Triflumuron.

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