Fresco: intangible heritage as a key to unlocking the links between the conservation of biological and cultural diversity in Alamos

Daan Hoekstra
Visual artist and independent researcher, Fondo Estatal para la Cultura y las Artes de Sonora, Mexico

ABSTRACT
Alamos, Sonora, Mexico contains world-class heritage and is on the tentative list for World Heritage status. The colonial architecture in the town centre has been declared a National Historic Monument and a unique eco-system of incomparable biodiversity and is protected under UNESCO’s network of biosphere reserves. Local indigenous groups keep alive a wealth of information about practical and medicinal uses of plant species. External forces threaten the natural, cultural and intangible heritage of the region. The UNESCO guidelines for identifying and clarifying bio-cultural diversity call for multiple regimes of credibility and an interdisciplinary, holistic approach. This paper explores links between biological and cultural diversity seen through the lens of the global intangible tradition called fresco painting. An artist’s perspective identifies previously unnoticed connections as well as economic alternatives to destructive land-use patterns, resulting in concrete proposals for the conservation of natural, cultural and intangible heritage in Alamos. Fresco is an ideal model for explaining how an intangible tradition expresses itself and positively impacts on bio-cultural diversity at global, regional and local levels. The model answers UNESCO’s call for frameworks and methodologies for recognising and describing the interdependence of nature and culture, and leads to an understanding of the quantitative value of diversity.

Introduction
New technologies and economic patterns often have a destructive impact on biological and cultural diversity and lead to the loss of traditional knowledge. The study of bio-cultural diversity - one of the most promising new fields that has emerged in an attempt to address these tragic losses - recognises that biological, cultural and linguistic diversity are inextricably linked,¹ that diversity is threatened by common forces, and that common conservation strategies ought to be explored.²
If new technologies erode traditional cultures, the re-introduction of an ancient technology could have a healing effect.

This paper explores these issues in relation to a small Mexican town. Alamos, Sonora, contains world-class cultural, natural and intangible heritage - unique for such a small place. Its colonial architecture has been declared a National Historic Monument and Alamos is on the tentative list for World Heritage status. The environs contain incomparable bio-diversity within an unusual eco-system where the Sonoran desert meets the Sierra Madre and the more humid rainforests to the south. The area’s Tropical Deciduous Forest is protected under UNESCO’s network of biosphere reserves. The outlying region is inhabited by the Mayo and Guarijio Indians, keepers of a wealth of information about the practical uses of local plants.

The heritage of the region has been eroded by globalisation and modernisation. Development, population growth, deforestation and a new wave of mining activity threaten bio-diversity. A desert could replace what is now a seasonal tropical rainforest. Hundreds of colonial buildings in the historic centre are registered monuments but they are endangered due to a lack of awareness about proper methods and materials for conservation. Historic homes are remodelled with little sensitivity to authenticity. The most damaging practice is an overuse of Portland cement in old adobe and masonry buildings, a practice condemned by conservation authorities worldwide. The vinyl paint currently used is also inappropriate and prevents walls from breathing.

Intangible heritage - which refers not to artistic products, but rather to the knowledge, values and practices that bring them into existence - will be key to the process of preservation. It can be argued that modern technologies, lifestyles, cultures and economies are unsustainable because of their distance from nature, while pre-modern traditions were sustainable because of their proximity to it.

What would happen if an age-old intangible tradition were re-injected into the present-day situation in Alamos? Could the technology be useful in the modern world? When considering the possibilities it is hard to ignore the amazing knowledge of plant diversity that is still guarded by local indigenous cultures. This will later prove essential. For now, we will address the intangible heritage called fresco painting.

Fresco is a technique used for painting murals. Pigments ground in water are painted on to walls finished with fresh lime plaster. The moist wall absorbs the pigments. When the wall dries, the pigments are chemically sealed inside the wall. The materials used in fresco painting are simple: lime, water, sand and pigments.

In the rush to protect intangible heritage worldwide, fresco painting as a practice - a traditional craft relying on knowledge passed down from generation to generation, and based on a knowledge of nature - has largely been forgotten. A fresco as a product is cultural heritage. Fresco as practice, process and traditional craft is intangible heritage. This paper will address the intangible aspect, how it helps to define links between biological and cultural diversity in Alamos and the conservation strategies it brings into focus.

The development of lime technology and fresco painting worldwide

The development of fresco depended upon the birth of lime technology - a milestone in history. Lime is made by heating limestone to form calcium oxide, which is then slaked with water to form calcium hydroxide, used as plaster. When the plaster sets it releases water and absorbs carbon dioxide to return to its original state - limestone.

Learning to work with lime was one of humanity’s most sophisticated technological developments during the Stone Age. Relying upon their knowledge of nature, people learned to process stone, make it malleable, shape it according to their wishes and make it return to stone. Thus lime technology had a religious significance in some early cultures because it was associated with the act of creation. The process was perfected during the Neolithic period around 12,000 BC. The high temperatures needed to burn lime signalled the beginning of pyro-technology, a prerequisite of metallurgy.

On a worldwide level, the use of lime has a number of
advantages for the conservation of biological and cultural diversity.

By the time the first frescos were painted in Crete around 1500 BC, lime technology had spread around the world. The art of fresco followed quickly. Some of the earliest instances are:

- 1500 BC Knossos, Crete
- 1200 BC Thebes, Egypt
- 470 BC Ancient Greece
- 100 BC Manchuria
- 100 AD Pompeii, Italy
- 400 AD Pyongyang, Korea
- 500 AD Ajanta, India
- 500 AD Russia, Ukraine, the Balkans
- 675 AD Japan

### Fresco in Mexico

Mural painting was widespread throughout pre-Columbian Mexico, most notably among the Maya. Many Mayan frescos are still in existence today – which is amazing since most are found in hot, humid tropical regions. One of the oldest, in Bonampak Chiapas, dates from 800 AD. Researchers have long known that a brilliant blue produced by the Maya was made with indigo. Until recently, it was not understood why the blue did not fade in the same way indigo dye in blue jeans fades. Recent research indicates that Maya Blue was made by heating indigo with a white clay called palygorskite. The indigo molecules lodged themselves inside the tube-like clay molecules to make the blue more resistant to acid, alkali, sunlight and humidity.

Researchers at the University of Texas, El Paso have imitated Mayan technology to create a line of pigments that surpass modern pigments in being light and chemical resistant. In their production and use they are less toxic and more ecologically sound than existing commercial pigments.

Just as they did in their pigments, the Maya employed the combination of organic and inorganic chemistry in their lime technology. The Mayan approach was more advanced than its Old World counterpart. For example, statutes during the Roman Empire insisted that lime for construction be slaked for three years prior to use - a rule of thumb still used by restorers and fresco painters today. The Maya slaked lime with a liquid obtained from the bark of a tree. The sugars in the mucilage accelerated the slaking process so the lime was ready to use in two weeks. The result is an especially hard and durable plaster.

### Fresco as a key to unlocking the links between the conservation of biological and cultural diversity in Alamos

Lime and pigment technology in Alamos employed innovations pioneered by the Maya. The plaster technology was probably carried to Alamos by Spanish settlers who picked up the knowledge in central or southern Mexico. Seri pigment technology may have existed prior to the conquest.

An examination of the plant species in the Alamos area that have been used for pigment production, plaster production, binders and varnishes sheds further light on the relationship between the conservation of both biological and cultural diversity. An artist’s perspective...
steeped in the intangible tradition of fresco painting acts as an aid to recognising links between nature and culture, resulting in concrete proposals for conservation strategies.

Some Alamos plant species and their relation to the conservation of biological and cultural diversity

Alamos is rich in plants that are used as dyes. The potential for the sustainable development of colourants as an economic alternative to the present destructive patterns of land use should not be underestimated. The international demand for dyes is about 800,000 tons per year, valued at £2.5 billion.  

**Red Pigments**

The Guarijio used ‘brasil’ wood (Haematoxylum brasiletto) to make a dye for coloring palm for making baskets.  

‘Brasil’ is a legume, which is important for maintaining healthy soil. It may be ecologically desirable to explore the commercial value of growing this for its dye and medicinal properties as an alternative to the over-harvesting of it for firewood.

**Blue Pigments**

Guayacan (Guaiacum coulteri) is native to the Guarijio territory near Alamos.  

Indigo (Indigofera suffructosa) is native to Alamos and grows wild on the outskirts of the town. The Mayo and Guarijio used indigo to dye fabrics.
pollution and is currently a global problem. Environmental organisations and the public are calling for an alternative.\textsuperscript{15}

Indigo production makes good sense for Alamos. It is another legume and improves the soil. It is perennial, self-propagating and can be harvested without killing the plant. The potential income could compete with that from destructive cattle ranching which is practiced there at present. Gathering and processing leaves could reinvigorate the existing indigenous craft practices and encourage better stewardship of the land.

\textbf{Yellow Pigments}

Children in Alamos colour Easter eggs with pionilla (\textit{Erythrina flabelliformis}) and Mayo weavers boil the bark to make a yellow dye.\textsuperscript{16}

In Alamos, the fruit of sanjuanico (\textit{Jacquinia macrocarpa pungens}) was used to make soap. Throughout the region, the flowers were strung to make necklaces - by the Seri, Yaqui and Mayo people. The flowers can be dried and stored for decades. When rehydrated with water they look as if they are freshly-picked.\textsuperscript{17}

One of the last Mayo weavers, Doña Maria Soledad Moroyoqui, boils the flowers of sanjuanico to make a yellow fabric dye.\textsuperscript{18}

\textbf{Gums, resins and binders}

Tree resins are economically important because of their extensive use in perfumes, incense, medicines and the food industry. For the artist, resins are especially important as binders, paint mediums and varnishes.

Mexico is a major supplier of resin. In 1994, it produced 36,731 tons, including 22,000 tons of gum rosin and 4,000 tons of turpentine.\textsuperscript{19} Sustainable development of resins offers promising possibilities for alternatives to the present destructive uses of land.

Samo (\textit{Heliocarpus attenuates}) is a common small tree in the Alamos area. The mucilage was used in the preparation of lime plaster and as a binder for paint. The combination of the organic samo with inorganic lime and pigments resembles the paint and plaster technology of the ancient Maya, known for its durability. The Maya used a tree they called holol.\textsuperscript{20} Holol refers to a variety of species, one of which is \textit{Heliocarpus donnell}.

To prepare the mucilage, the Guarijio soak strips of bark in water. The mixture is sometimes boiled. The water is then mixed with sand and lime to make plaster, or with lime/and or pigments to make paint.\textsuperscript{22}

Samo will be essential to any future effort to restore Alamos’ colonial architecture. Very few authentic paint and plaster surfaces remain because almost all of them have been ruined by the use of vinyl paint and plaster containing Portland cement.

The Mayo soak the wood of vinorama (\textit{Acacia farnesiana}) in water to make a blue dye.\textsuperscript{23} The Aztecs used \textit{Acacia farnesiana} gum as a paint binder\textsuperscript{24} which suggests that it could be a suitable substitute for gum arabic - an African gum from \textit{Acacia senegal} and \textit{Acacia seyal}. First used as a binder in inks and cosmetics, gum arabic now has a multitude of industrial uses. It is completely edible and is used in processed foods as a glue, thickener, binder, extender and to give texture. It is also the binder most commonly used in watercolour paint.

Honey that comes from mesquite flowers (\textit{Prosopis glandulosa}) is prized for its flavour. The seedpods are an important source of animal fodder and are used to make a variety of foods.\textsuperscript{25} Mesquite performs an important ecological role throughout Mexico by providing a fixative for the nitrogen that helps enrich the soil in arid regions. This attracts plant species which enjoy the richer soil and they in turn support various species of animals.\textsuperscript{26}

Mesquite is widespread in the Alamos region and is an important source of firewood and lumber. Unfortunately, using the wood for lumber, furniture, firewood and charcoal is causing deforestation. Academics are advocating more sustainable uses for mesquite - in the production of honey, food, fodder and medicines.\textsuperscript{27}

Another possibility for sustainable use involves producing mesquite gum which is very similar to gum arabic. World demand for gum arabic is about 45,000
tons per year. In 2003, Mexico imported 7,000 tons of gum arabic at a cost of nearly four million dollars. The availability and price of gum arabic on the world market varies greatly because there are frequent scarcities due to the political situation in Africa, especially in the Sudan. It makes good economic sense for Mexico to pursue a domestic alternative.

Dr. Yolanda L. Lopez-Franco, from the Centro de Investigacion en Alimentacion y Desarrollo A.C. in Hermosillo, Sonora, was part of a team that investigated the potential of mesquite gum. The team found that the chemical characteristics, emulsifying properties and molecular structure of the gum made from *Prosopis glandulosa* would make it a suitable alternative to gum arabic.

Developing mesquite gum production in Sonora would have a positive environmental impact in the same way that the production of gum arabic does in Africa. There, production of gum arabic from *Acacia senegal* has effects such as

- reducing desertification due to the control of the erosion and enrichment of soil nutrients, providing local populations with an additional source of income, awakening rural populations to a sustainable use of natural resources.

*Burseraceae*, a member of the torchwood family, is known for its aromatic resins. The Guarijio collect the resin of *torote copal* (*Bursera stenophylla*) to burn as incense in churches, to freshen the air in their homes and to use in teas as a remedy for the common cold.

The word *copal* comes from the Nahuatl *copalli* and copal varnish enjoys a long and important history as an artist’s material. In pre-Columbian times copal was used primarily in religious rituals. The Mayo used *torote colorado* (*Bursera simaruba*) for making a light brown dye for weaving. The resin of *torote colorado* is also burnt as incense in churches in Guatemala, and was one of the prime sources of ritual copal used by the pre-Columbian Maya. *Bursera simaruba* has been employed commercially to make turpentine, glue and varnish, and it has been suggested that its resin could be used as another substitute for gum arabic.

The Mayo used *Bursera microphylla* to make textile dyes. The Seri used elephant tree resin to seal cracks in boats and pottery. Specific conservation strategies - the interplay of global, regional and local articulation

A globally recognised intangible tradition [fresco] leads to the recognition of global, regional and/or local
**Fresco: Intangible Heritage as a Key to Unlocking the Links between the Conservation of Natural, Cultural and/or Intangible Heritage**

**Proposals**

<table>
<thead>
<tr>
<th>Proposal</th>
<th>Recognition</th>
<th>Confirmation</th>
<th>Synergy</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Explore the cultivation of flavonol glycosides in the local and regional context and their potential as a source of income.</td>
<td>Local: The Mayo used flavonol glycosides to make a red pigment.</td>
<td>Global: Flavonol glycosides are used worldwide as a pigment.</td>
<td>Happy coincidence.</td>
</tr>
<tr>
<td>2. Explore the stability of the Seh Blue pigment as a source of income, with the potential to be produced without harming the Guayacum coulteri trees.</td>
<td>Conservation focus: NH, CH</td>
<td>Regional: The Seh Indians produced a blue pigment from Guayacum coulteri, by combining organic and inorganic chemistry.</td>
<td></td>
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<td>3. Promote the local and regional use of Helichrysum annuum in the conservation of cultural heritage as a plaster additive and paint binder.</td>
<td>Conservation focus: NH, CH</td>
<td>Regional: The Maya used a similar Helichrysum species as a lime additive to enhance the slaking process.</td>
<td></td>
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<tr>
<td>4. Promote gathering and small-scale cultivation of Indigofera suffruticosa, as well as sustainable indigo dye production.</td>
<td>Conservation focus: NH, CH</td>
<td>Regional: Indigo is an important commodity and an important source of income.</td>
<td></td>
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<tr>
<td>5. Promote the collection and sale of mesquite gum.</td>
<td>Conservation focus: NH, CH</td>
<td>Regional: Mesquite is a legume and improves soil health.</td>
<td></td>
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<tr>
<td>6. Promote local copal resin production from Bursera microphylla and Bursera stenophylla.</td>
<td>Conservation focus: NH, CH</td>
<td>Regional: The origin of the world’s best copal is from the Nahuatl culture.</td>
<td></td>
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<td>7. Promote the use of locally produced lime, for the reasons listed in Figure 2.</td>
<td>Conservation focus: NH, CH</td>
<td>Regional: Lime is promoted worldwide for its beneficial role in the conservation of natural and cultural heritage.</td>
<td></td>
</tr>
<tr>
<td>8. Investigate Bursera arnottiana as a possible source of turpentine and varnish.</td>
<td>Conservation focus: NH, CH</td>
<td>Regional: Turpentine is produced to make turpentine, glue and varnish.</td>
<td></td>
</tr>
</tbody>
</table>

**Notes:**

- NH: Natural heritage. Sustainable use of forest products, alternative to destructive land use patterns and alternatives to wasteful industrial practices. CH: Intangible Heritage: preservation of traditional knowledge and crafts. CT: Cultural Heritage: proper methods and materials for restoration.

**Conclusion**

An investigation into bio-cultural diversity is a journey into a web with multiple levels of linkages. For example, links between tangible and intangible heritage, eloquently established by Mounir Bouchenaki, can help clarify the links between biological and cultural diversity. Intangible practices and processes often rely upon knowledge of bio-diversity, resulting in diverse tangible products. Natural and intangible heritage are the deeper sources of tangible cultural heritage and the sources of its deeper meanings.

Intangible heritage could be seen as the intermediary between nature and culture that unites a knowledge of natural processes with the production of artifacts. If one aspires to having unified strategies for protecting both nature and culture, knowledge of natural processes...
works in both directions. One could then speak of the primacy of intangible heritage and the need to protect it first as a prerequisite to environmental conservation and the safeguarding of artifacts. The urgency could not be clearer. As Bouchenaki noted, intangible heritage is the most fragile element in the web of interconnections, requiring the most delicate intervention.

Fresco painting practices and processes are a global intangible tradition with a number of unique regional and local manifestations - an ideal example of *unity in diversity*. Bio-cultural researchers speak of the *moral imperative* to resist homogenisation and uniformity, and instead strive towards *unity in diversity* as our best hope for a sustainable future.  

Change and modernisation erode cultural, natural and intangible heritage around the world. The same drivers lead to disintegration wherever it may be. If reintegration and healing are to occur, logically they should be driven by common catalysts as well.

Fresco is an ideal model for explaining how a resilient global intangible tradition re-articulates itself and impacts positively on bio-cultural diversity at global, regional and local levels. The model answers UNESCO’s call for frameworks and methodologies for recognising and describing the interdependence of biological and cultural diversity.

**Acknowledgements**

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NOTES

1. Declaration of Belem, 1988, Belem. This document, a result of The First International Congress of Ethno-biology, recognises the stewardship role of indigenous people and its importance for the preservation of biological and cultural diversity. www.ethnobiology.net/_common/docs/DeclarationofBelem.doc


8. Ibid.


10. Kerpel, Diana Magalona, 1997, ‘La cal y los mayas’ in La Pintura Mural Prehispánica en México; Boletín Informativo: Año III, Números 6-7, UNAM, México DF, Julio-Diciembre 1997: pp.5-8. It is interesting to note that the fresco tradition of the Indian subcontinent also combined lime with vegetal matter, according to Annet Both, a fresco practitioner in Holland.

11. Report from the State of the United Kingdom forming part of the IENICA Project, Prepared by: ACTIN, Pira House, Randalls Road, Leatherhead, Surrey, 158. See also the National Non-Food Crops Centre website, http://www.nnfcc.co.uk/metadot/index.pl?id=2165;isa=Category;op=show [consulted June 2, 2009].


15. SPINDIGO Project http://www.spindigo.net/ SUMMARY.htm [consulted May 26, 2009]


26. Ibid.
27. Ibid.
28. Ibid.
29. Ibid.
31. Guarijios of Sonora, op cit: p.188.
33. Génesis y Desarrollo, p.23.
34. Navarrete-Tindall, Nadia and Nuñez, Mario A. Orellana, Species Descriptions: Bursera simaruba, USDA Forest Service leaflet.
35. Stross, op cit.
37. Génesis y Desarrollo, p. 23. Numerous sources list Bursera microphylla as torote colorado, while torote colorado was identified as Bursera simaruba by Yetman, according to Guarajio usage.
39. The Parroquia de la Purísima Concepción de Álamos is currently being restored by Straulino Restauracion. The author is a member of the restoration team.
40. Bouchenaki, Mounir, op cit.