THE SECOND INTERNATIONAL FORUM OF THE QUR'ANIC BOTANIC GARDEN

ISLAMIC PERSPECTIVES ON ECOSYSTEM MANAGEMENT

PROCEEDINGS OF THE SECOND INTERNATIONAL FORUM OF THE QUR'ANIC BOTANIC GARDEN

ISLAMIC PERSPECTIVES ON ECOSYSTEM MANAGEMENT

حديقة القرآن النباتية
QUR'ANIC BOTANIC GARDEN
عضو في مؤسسة قطر
Member of Qatar Foundation

CEM

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Qur'anic Botanic Garden, member of Qatar Foundation for Education, Science and Community Development, in collaboration with Commission on Ecosystem Management of International Union for Conservation of Nature (IUCN)
22nd - 24th April, 2014
Doha, Qatar

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EDITORS
PIETER WIT & MOHAMED M. HASSONA

REVISED BY
FATIMA BINT SALEH AL-KHULAIFI

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Islamic Perspectives on Ecosystem Management

Edited by: **Dr Pieter Wit,** Chair, Commission on Ecosystem Management, International Union for Conservation of Nature (IUCN).

Mr. Mohamed M. Hassona, Horticulturist, Qur'anic Botanic Garden, Qatar Foundation for Education, Science and Community Development (QF).

Revised by: **Ms. Fatima bint Saleh Al-Khulaifi,** Project Manager of Qur'anic Botanic Garden, Qatar Foundation for Education, Science and Community Development

With contribution of:

- **Mr. Ahmed E. El-Gharib,** Assistant Researcher, Qur'anic Botanic Garden, Qatar Foundation for Education, Science and Community Development (QF).
- **Dr Edmund Barrow,** Director, Global Ecosystems Management Programme, International Union for Conservation of Nature (IUCN)
- **Dr Said A. Damhoureyeh,** Associate Professor of Plant Ecology, Department of Biological Sciences, Faculty of Science, University of Jordan.
- **Dr Stephen R. Edwards,** Commission on Ecosystem Management, International Union for Conservation of Nature (IUCN).

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Qur'anic Botanic Garden
Member of Qatar Foundation for Education, Science and Community Development
P.O. Box: 5825, Doha – Qatar
Phone: +974 44548301 Fax: +974 44548304
Email: qbg@qf.org.qa

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LECTURES IN ARABIC

IN THE NAME OF ALLAH, THE MOST GRACIOUS, A MOST MERCIFUL

And the earth - We have spread it and cast therein firmly set mountains and caused to grow therein [something] of every well-balanced thing. And We have made for you therein means of living and [for] those for whom you are not providers.

Sura Al-Hijr, verses 19 – 20
the Holy Qur'an

In the name of Allah, the Most Meciful, the Most Gracious

Praise be to Allah, and peace and blessings be upon His Messenger, Prophet Muhammad and his Family and Companions.

Based on the vision and launch of Her Highness Sheikha Moza bint Nasser, Chairperson of Qatar Foundation for Education, Science and Community Development (QF), of Qur'anic Botanic Garden (QBG) to raise awareness of the plants and principles of nature conservation mentioned in the Qur'an and the Hadith, the QBG, a QF project, is an active player in raising awareness to environmental conservation and sustainability in the State of Qatar.

Organizing the QGB's 2nd International Forum complements its first building block in scientific meetings. In accordance with the recommendations made by a group of scientists during the 1st International Forum held in Doha in March 2009 regarding the need to observe the environmental rules and considerations of the Sharia to protect and preserve natural resources, this Forum was held under the title 'Islamic Perspectives on Ecosystem Management.'

This scientific Forum is a major event to effectively introduce QF activities in environmental areas, environmental conservation and sustainable development, as well as to realize Qatar National Vision 2030 and work under Qatar National Development Strategy 2011-2016. It is a necessary stage for cooperation and connection between the QBG in its embryonic stage and relevant local and international institutions. The QBG has deemed it necessary to hold this forum in collaboration with a major international organization, namely the International Union for Conservation of Nature (IUCN) and thus it cooperated with one of its efficient committees, the Commission on Ecosystem Management (CEM).

What distinguishes an ecosystem is the delicate balance among its components. All the Abrahamic religions call for the preservation of ecosystems and their components. Ecosystem management aims at maintaining environmental services and restoring natural resources to meet the economic, political, cultural and social needs of current and future generations. The Forum has helped make recommendations as initiatives for the future programs of QBG, CEM and all concerned parties.

QBG's concept emphasizes the principle of environmental and ecosystem conservation in Islam, and enhances that principle to realize sustainable development. This is in line with the primary objective of ecosystem management because the environmental principles mentioned in the Qur'an cover not only Muslims but also the entire humanity. Humans should exhibit virtuous values and sublime morals when dealing with their surroundings of solids or plants and should not destroy the integrated relationship between these entities. Allah, the Most Sublime, says [Indeed, in the creation of the heavens and earth, and the alternation of the night and the day, and the [great] ships which sail through the sea with that which benefits people, and what Allah has sent down from the heavens of rain, giving life thereby to the earth after its lifelessness and dispersing therein every [kind of] moving creature, and [His] directing of the winds and the clouds controlled between the heaven and the earth are signs for a people who use reason. [Al-Baqara - 164] shows how delicate the system linking these entities and nature is.

This book contains a number of papers and research works which were discussed during the Forum on Islam and environmental conservation, Islamic values and principles, and the perspective of Abrahamic religions on ecosystems conservation. The book shows examples from different ecosystems and explores the opportunities and challenges of managing them. It also contains a number of papers on the sustainable management of botanic gardens, in addition to the traditional knowledge and its role in ecosystem management. The book also includes academic papers by a number of local agencies and regional and international organizations, which show their plans and perspectives on the management and support of ecosystems and botanic gardens.

Finally, I would like to extend my sincerest thanks and appreciation to the QBG team and CEM for organizing this forum and preparation of this book which enriches the global library in ecosystems and botanic gardens alike.

The last of our prayer is: Praise be to Allah.

Fatima bint Saleh Al Khulaifi
Chairperson of the Forum
Project Manager of Qur'anic Botanic Garden
Qatar Foundation for Education,
Science and Community Development

Introduction

Being a Garden of international, Islamic and cultural standing, in fulfilling its vision, mission and objectives of Qatar Foundation, the Qur'anic Botanic Garden (QBG)is pleased to host the 2nd International Forum in collaboration with Commission on Ecosystem Management (CEM) of the International Union for Conservation of Nature (IUCN) and sponsored by Qatar Petroleum (QP).

The Forum, entitled "Islamic Perspectives on Ecosystem Management", gathered specialists in Islam and other faiths, ecologists, ecosystem managers, scholars from botanic gardens, and other relevant disciplines to exchange ideas and experiences about future programs to serve the objectives of the Qur'anic Botanic Garden and the Commission on Ecosystem Management. The sessions organized by the Qur'anic Botanic Garden highlighted Islamic principles, values and ethics that promote the conservation of plants, cultural traditions and ecosystems. The efforts of local and regional authorities to preserve the environment were showcased.

The CEM contribution to the Forum explored broader relationships between faith and spirituality and the natural environment and how this relationship can provide as a basis for healing and conservation. Sessions explored how links between traditional knowledge in different cultures and ecosystem management and that knowledge can contribute to conservation of nature's resources.

From this Forum the Qur'anic Botanic Garden aimed to identify new initiatives that can help and promote its conservation and educational programs. The Qur'anic Botanic Garden and the Commission seek guidance on how to build on the linkages and synergies between knowledge-based traditions and environmental management and to discuss how Islam and other religious teachings might be incorporated into conservation initiatives.

Concluding Forum recommendations will foster regional collaborative efforts and inform and guide both the Qur'anic Botanic Garden and the Commission in their future endeavors.

Together, the Qur'anic Botanic Garden and the Commission on Ecosystem Management honored the contributions of Professor Kamal El-Batanouny, former scientific advisor of the QBG, for his contributions to enhance understanding of dry-lands ecology, traditional medicine and medicinal plants.

Forum's Objectives

1. Highlight the work of the Qur'anic Botanic Garden in the State of Qatar especially in Ecosystem management from the Islamic perspectives.
2. Bring together and engage local and international researchers, stakeholders and managers to deepen their understanding of how Islam and other faiths relate to the environment so as to foster more effective conservation of ecosystems.
3. Improve & stimulate international cooperation and exchange of ideas on the topics of Ecosystems managements, Botanic Gardens' managements, and traditional knowledge based on botany.
4. Explore new initiatives that can help and promote the role of the Qur'anic Botanic Garden in sustainable conservational programs.

Themes & Overview of key presentations

The second international of the Qur'anic Botanic Garden is going to represent around 26 scientific papers relevant multi-disciplines approaches. Papers were focused on the below main themes;

1. **Qur'anic Botanic Garden: Islamic practices and perspectives of other religions in ecosystem conservation.** The lectures are going to highlight the principals of conservation, Policies of conservation, Ethics and other faiths based on Islam and other divine religions.
2. **Exploring opportunities and challenges in Ecosystem management**. During this session, the presentations will focus on Ecosystems elements (based on botany) throughout representing of different Ecosystems' case studies.
3. **Sustainable management of the Botanic Gardens.** The QBG is going to invite experts from different botanic Gardens to represent their Conservational, Educational, Museums programs.
4. **The role traditional knowledge plays in ecosystem management.** In this session a series of lectures based on traditional knowledge and botany. The topics will focus on plant's economic uses and traditional conservational concerns. Other presentations may be added, but within the session's scope.
5. **Building a framework for collaboration to foster Ecosystems Management.** During this session, the national and international stakeholders will represent their approaches towards the Ecosystems management. Avenues to foster collaboration that links local knowledge and experience to global policy initiatives will be explored.
6. **Bringing it all together: Framing outcomes and recommendations.** Participant will have the opportunity to contribute to the development of concrete recommendations to the Qur'anic Botanic Garden and the Commission on Ecosystem Management to explore opportunities for their future programming.

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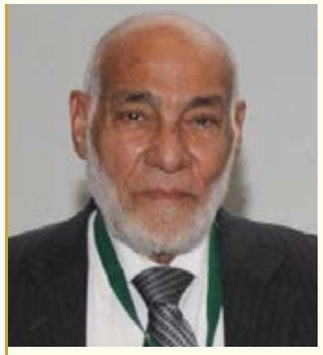
Plenary Lecture

CONSERVATION OF THE ENVIRONMENT IN ISLAM

Dr Zaghloul El-Naggar



Dr Zaghloul El-Naggar
Visiting Professor
The World Islamic Sciences and Education University
Amman - Hashemite Kingdom of Jordan

ABSTRACT

Islam establishes the fact that everything in this world is created with perfection, precision and exact balancing .This is demonstrated by both the details of our planet, and its numerous relationships with the rest of the cosmos. The interaction between the earth's atmosphere, hydrosphere, lithosphere and biosphere is a living example for such precision. Similarly, man is created in the best of form, is given enough reason and free will, is entrusted with the planet earth, and is considered to be its vicegerent. To carry out the responsibilities of this vicegerency, man is given the divine guidance. However, drifting away from such guidance, man started to be a destructive element on the surface of our planet. Through ignorance, greed, selfishness, carelessness, aggression, extravagance and many other injustices, man started to disrupt the natural balance of our planet.

Consequently, the gradual deterioration of the earth's different environments has become a real threat to the human existence, to life – in general – and to the plant life – in particular – due to the very delicate nature of plants. Because of this, Islam rules that any mischief exercised by man on the surface of our planet will be accounted for in this world and in the world-to-come. Such mischief can be of a purely material nature, of an abstract nature, or of both. Material deterioration of the earth's environment includes both its physical, chemical and biological pollution, as well as the excessive exhaustion of its resources. Abstract deterioration is clearly demonstrated by the loss of the proper rules of man's stewardship on earth.

INTRODUCTION

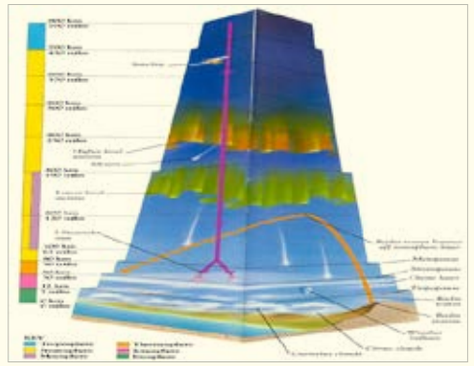
During the winter of 1952, the city of London, England was covered by a thick, black fog for several days. This fog was highly polluted with the industrial waste pouring out into the atmosphere from several chimneys in the city, causing the death of more than 4000 individuals. After the disappearance of this black fog, its pollution lasted for more than 15 days. Such pollution was repeated several times in the atmosphere of London and of other European cities, reaching its worst during the winter of 1962. Only then, Western scholars came to realize the dangers of pollution, and the need for measuring its rates, particularly in heavily populated industrial cities.

However, the glorious Quran has been -for more than 14 centuries- warning from corrupting the environment and advocating a balanced relationship between man and his ecosystem on the basis of both sustainable use and conservation.

Nevertheless, people have generally been drifting away from this guidance, causing great destruction to the different ecosystems of the earth, including habitat corruption, both plant and animal species elimination, desertification, deforestation, devastating climatic changes, exhaustion of the resources, among other negative ways of corruption. This started with the early days of the 18th century industrial revolution, when numerous wasteful and invasive consumer societies have been developing on the surface of our planet, threatening the balance of life on its surface. This has been intensified with the beginning of using fossil fuels such as coal, petroleum and natural gas to generate energy. Burning more than 100 million barrels of oil, 80 million tons of coal added to trillions of cubic feet of natural gas every day has led to the fact that the earth's atmosphere has been continuously polluted by around 100 million tons of CO2 every day, added to many other poisonous gases. Consequently our planet started to suffer from global warming and its drastic effects, threatening the natural balance of its ecosystems and all forms of life, including man.

The only way out of this dilemma is to adhere to- the Islamic environmental ethics, which are both faith-based and virtue-based. In the Islamic teaching man is considered to be both a vicegerent on earth and a trustee for its ecosystem. The power of religious belief and its ethics are the only control to put conservation into its effective practice, as all utilitarian concepts have failed completely.

The Earth is created with great perfection



The atmosphere of the Earth is created with due measure.

ISLAMIC CONTROLS FOR CONSERVING THE ENVIRONMENT:

A. Allah (all glory be to Him) is the Creator of everything, and hence everything is His possession:

﴿ ذَلِكُمُ اللَّهُ رَبُّكُمْ لاَ إِلَهَ إِلاَّ هُوَ خَالِقُ كُلِّ شَيْءٍ فَاعْبُدُوهُ وَهُوَ عَلَى كُلِّ شَيْءٍ وَكِيلٌ* ﴾ (الأنعام: ١٠٢).

"Such is Allah, your Lord, none has the right to be worshipped but He, the Creator of everything. So worship Him (alone), and over everything He is the Disposer*"(6:102).

﴿ ...قُلِ اللَّهُ خَالِقُ كُلِّ شَيْءٍ وَهُوَ الوَاحِدُ القَهَّارُ* ﴾ (الرعد: ١٦).

"…Say: Allah is the Creator of everything, and He is the One, the Irresistible*" (13:16)

﴿ اللَّهُ خَالِقُ كُلِّ شَيْءٍ وَهُوَ عَلَى كُلِّ شَيْءٍ وَكِيلٌ* ﴾ (الزمر: ٦٢).

"Allah is the Creator of everything, and He is the: Guardian and Disposer of everything *" (39:62).

﴿ ذَلِكُمُ اللَّهُ رَبُّكُمْ خَالِقُ كُلِّ شَيْءٍ لاَ إِلَهَ إِلاَّ هُوَ فَأَنَّى تُؤْفَكُونَ* ﴾ (غافر: ٦٢).

"That is Allah your Lord the Creator of everything, there is no deity but He, then how are you deluded away from the truth*" (40:62).

B. Allah's creation is perfect and well-balanced:

﴿ ... وكُلُّ شَيْءٍ عِندَهُ بِمِقْدَارٍ* ﴾ (الرعد: ٨).

(….And everything with Him is in due measure*). (13:8).

﴿ قَالَ رَبُّنَا الَّذِي أَعْطَى كُلَّ شَيْءٍ خَلْقَهُ ثُمَّ هَدَى* ﴾ (طه: ٥٠).

He (Moses) said: "Our Lord is the One Who gave everything its creation (form and nature), then guided it aright*) (20:50).

﴿ وَالأَرْضَ مَدَدْنَاهَا وَأَلْقَيْنَا فِيهَا رَوَاسِيَ وَأَنْبَتْنَا فِيهَا مِن كُلِّ شَيْءٍ مَّوْزُونٍ. وَجَعَلْنَا لَكُمْ فِيهَا مَعَايِشَ وَمَن لَّسْتُمْ لَهُ بِرَازِقِينَ. وَإِن مِّن شَيْءٍ إِلاَّ عِندَنَا خَزَائِنُهُ وَمَا نُنَزِّلُهُ إِلاَّ بِقَدَرٍ مَّعْلُومٍ*) (الحجر: ١٩-٢١)

And the earth we have spread out, and have thrown therein stabilizers (mountains), and have planted in it from everything in due balance *And We have provided therein means of living, for you and for those which you provide not (other living beings) * And there is not a thing, but with Us are its stores. And We do not send it down except with a well-known measure*) (15:19-21).

﴿ ... وَخَلَقَ كُلَّ شَيْءٍ فَقَدَّرَهُ تَقْدِيراً* ﴾ (الفرقان: ٢).

(….And He created everything, and destined it according to its exact estimation*) (25:2).

﴿ إِنَّا كُلَّ شَيْءٍ خَلَقْنَاهُ بِقَدَرٍ ﴾ (القمر: ٤٩).

(Verily, We created everything with due measure*) (54:49).

Every form of Allahs creation (animate or inanimate has a certain degree of sense, feeling, reaction and expression and hence, it knows its Creator, worships and glorifies Him. Due to these facts, man is clearly and irrevocably interwoven into the fabric of his environment. By corrupting its ecosystem, he is clearly damaging himself. Consequently a balanced relationship between man and his environment becomes both a religious and a utilitarian obligation.

﴿ وَمَا مِن دَابَّةٍ فِي الأَرْضِ وَلاَ طَائِرٍ يَطِيرُ بِجَنَاحَيْهِ إِلاَّ أُمَمٌ أَمْثَالُكُم مَّا فَرَّطْنَا فِي الكِتَابِ مِن شَيْءٍ ثُمَّ إِلَى رَبِّهِمْ يُحْشَرُونَ* ﴾ (الأنعام: ٣٨).

"There is not an animal (that lives) on the earth, nor a bird that flies by its two wings, but (form part of) communities like you (human beings). Nothing have We left out from the Book, and they (all) shall then be gathered to their Lord*" (6:38)

﴿ تُسَبِّحُ لَهُ السَّمَوَاتُ السَّبْعُ وَالأَرْضُ وَمَن فِيهِنَّ وَإِن مِّن شَيْءٍ إِلاَّ يُسَبِّحُ بِحَمْدِهِ وَلَكِن لاَّ تَفْقَهُونَ تَسْبِيحَهُمْ...* ﴾ (الإسراء: ٤٤).

(The seven heavens and the earth, and all beings therein, declare His glory: there is not a thing but celebrates His praise; and you understand not how they declare their glorification…*) (17:44).

﴿ أَلَمْ تَرَ أَنَّ اللَّهَ يَسْجُدُ لَهُ مَن فِي السَّمَوَاتِ وَمَن فِي الأَرْضِ وَالشَّمْسُ وَالْقَمَرُ وَالنُّجُومُ وَالْجِبَالُ وَالشَّجَرُ وَالدَّوَابُّ وَكَثِيرٌ مِّنَ النَّاسِ*... ﴾ (الحج: ١٨) .

"Don't you see that to Allah bow down in worship all that are in the heavens and on the earth, the sun, the moon, the stars; the mountains, the trees, the animals; and many human beings…*" (22:18).

D. Man's Responsibility about the Earth

Man is created as the vicegerent, guardian and steward of the earth. Hence, he is allowed to reap its rewards and preserve it from any destruction.

﴿ وَإِذْ قَالَ رَبُّكَ لِلْمَلاَئِكَةِ إِنِّي جَاعِلٌ فِي الأَرْضِ خَلِيفَةً...* ﴾ (البقرة: ٣٠).

And (remember) when your Lord said to the angels: "Verily, I am going to make a vicegerent on earth…..*"(2:30).

﴿ وَهُوَ الَّذِي جَعَلَكُمْ خَلاَئِفَ الأَرْضِ وَرَفَعَ بَعْضَكُمْ فَوْقَ بَعْضٍ دَرَجَاتٍ لِّيَبْلُوَكُمْ فِي مَا آتَاكُمْ إِنَّ رَبَّكَ سَرِيعُ العِقَابِ وَإِنَّهُ لَغَفُورٌ رَّحِيمٌ* ﴾ (الأنعام: ١٦٥).

And He (Allah) is the One Who made you vicegerents on the earth (generations, replacing each other). And He has raised some of you in ranks, above others that He may try you in that which He has bestowed on you…*) (6:165).

﴿ هُوَ الَّذِي جَعَلَكُمْ خَلاَئِفَ فِي الأَرْضِ فَمَن كَفَرَ فَعَلَيْهِ كُفْرُهُ وَلاَ يَزِيدُ الكَافِرِينَ كُفْرُهُمْ عِندَ رَبِّهِمْ إِلاَّ مَقْتاً وَلاَ يَزِيدُ الكَافِرِينَ كُفْرُهُمْ إِلاَّ خَسَاراً* ﴾ (فاطر: ٣٩) .

"He (Allah) is the One Who made you vicegerents on the earth successors, generation after generation)….*" (35:39).

﴿ وَلَقَدْ مَكَّنَّاكُمْ فِي الأَرْضِ وَجَعَلْنَا لَكُمْ فِيهَا مَعَايِشَ قَلِيلاً مَّا تَشْكُرُونَ* ﴾ (الأعراف: ١٠)

And surely, We gave you authority over the earth and appointed therein provisions for you, rarely you are thankful (to your Lord*) (7:10).

﴿ هُوَ الَّذِي جَعَلَ لَكُمُ الأَرْضَ ذَلُولاً فَامْشُوا فِي مَنَاكِبِهَا وَكُلُوا مِن رِّزْقِهِ وَإِلَيْهِ النُّشُورُ* ﴾ (الملك: ١٥).

"He (Allah) is the One Who made the earth subservient to you (i.e. made it suitable for your living); so walk in its paths and eat of His provision and to Him will be the resurrection*" (67:15).

E. Forbidding the corruption of the earth's environment

(Corruption of the faith)

(Corruption of the acts of worship)

(Moral decay and corruption of dealings with others)

F- Material corruption of the earth

(Chemical pollution of the earth's environment).

(Physical pollution of the earth's environment).

(Biological corruption of the earth).

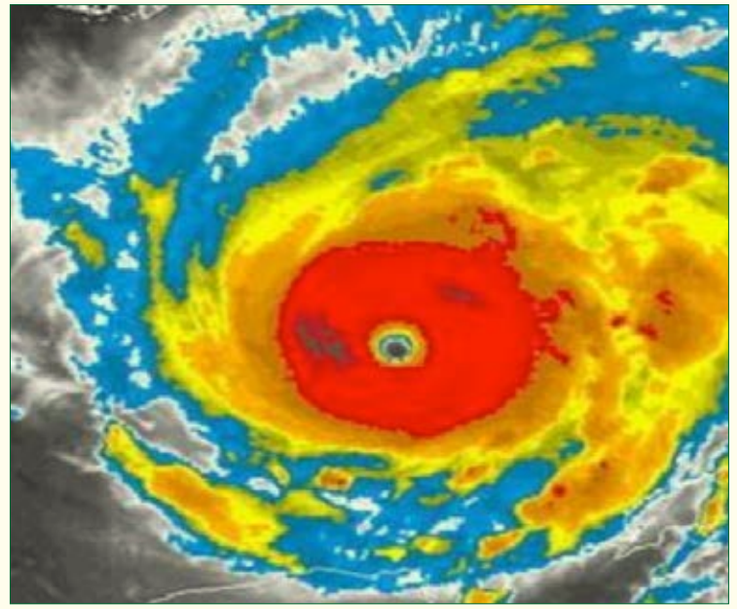
- Abuse of the earth's environment is islamically prohibited, and hence, is punishable in this world and in the world-to-come:

﴿ظَهَرَ الفَسَادُ فِي البَرِّ وَالْبَحْرِ بِمَا كَسَبَتْ أَيْدِي النَّاسِ لِيُذِيقَهُم بَعْضَ الَّذِي عَمِلُوا لَعَلَّهُمْ يَرْجِعُونَ*﴾
(الروم:٤١) .

Corruption has appeared in (both) the land and the sea by what the hands of human beings have committed , that He (Allah) may make them taste a part of what they have done, so that they may return*) (30:41).

Man has polluted the atmosphere of the Earth by the massive quantities of pollutants

Percentage of CO2 in the Earth s atmosphere has almost doubled since the industrial revolution.



Hurricanes have been intensified in number and magnitude since the industrial revolution.

Repeated nuclear explosions have also added a dangerous pollutant to the atmosphere of the Earth

﴿ الَّذِينَ يَنقُضُونَ عَهْدَ اللَّهِ مِنْ بَعْدِ مِيثَاقِهِ وَيَقْطَعُونَ مَا أَمَرَ اللَّهُ بِهِ أَن يُوصَلَ وَيُفْسِدُونَ فِي الأَرْضِ أُوْلَئِكَ هُمُ الخَاسِرُونَ ﴾ (البقرة: ٢٧)

Those who break Allah's Covenant after ratifying it, and sever what Allah has ordered to be joined and do mischief on earth, it is those who are the losers*) (2:27).

﴿ وَإِذَا تَوَلَّى سَعَى فِي الأَرْضِ لِيُفْسِدَ فِيهَا وَيُهْلِكَ الحَرْثَ وَالنَّسْلَ وَاللَّهُ لاَ يُحِبُّ الفَسَادَ ﴾ (البقرة: ٢٠٥).

"And when he turns away (from you) his effort on the earth is to make mischief therein and to destroy the cultivation, endanger the progeny (of life), and surly Allah likes not mischief *" (2:205).

﴿ وَلاَ تُفْسِدُوا فِي الْأَرْضِ بَعْدَ إِصْلاَحِهَا وَادْعُوهُ خَوْفًا وَطَمَعًا إِنَّ رَحْمَتَ اللَّهِ قَرِيبٌ مِّنَ الْمُحْسِنِينَ* ﴾ (الأعراف: ٥٦).

And do not do mischief on the earth, after it was set in order, and invoke Him with fear and hope. Surely, Allah's Mercy is (ever) near unto the good-doers*) (7:56).

﴿ ...وَلاَ تَبْغِ الفَسَادَ فِي الأَرْضِ إِنَّ اللَّهَ لاَ يُحِبُّ المُفْسِدِينَ* ﴾ (القصص: ٧٧).

"…and seek not mischief on the earth, verily, Allah likes not the mischief-makers *" (28:77).

﴿ تِلْكَ الدَّارُ الآخِرَةُ نَجْعَلُهَا لِلَّذِينَ لاَ يُرِيدُونَ عُلُواً فِي الأَرْضِ وَلاَ فَسَاداً وَالْعَاقِبَةُ لِلْمُتَّقِينَ* ﴾ (القصص: 83).

"That home of the Hereafter (i.e. the Paradise), We assign to those who neither seek arrogance on the earth nor mischief, and the good end is (definitely) for the pious ones*" (28:83).

﴿ فَهَلْ عَسَيْتُمْ إِن تَوَلَّيْتُمْ أَن تُفْسِدُوا فِي الأَرْضِ وَتُقَطِّعُوا أَرْحَامَكُمْ* ﴾ (محمد: ٢٢)

"Would you then, if you were given the authority, do mischief on the earth, and sever your ties of kinship?*" (47:22).

G. Wasteful extravagance is one of the grave damages to the earth's environment.

﴿ وَلاَ تُطِيعُوا أَمْرَ الْمُسْرِفِينَ* الَّذِينَ يُفْسِدُونَ فِي الأَرْضِ وَلاَ يُصْلِحُونَ* ﴾ (الشعراء: ١٥١، ١٥٢).

(And do not obey the bidding of the extravagant* Who make mischief on the earth and do not act aright*) (26:151,152).

﴿ ....وَلاَ تُسْرِفُوا إِنَّهُ لاَ يُحِبُّ الْمُسْرِفِينَ* ﴾ (الأعراف: ١٤١)

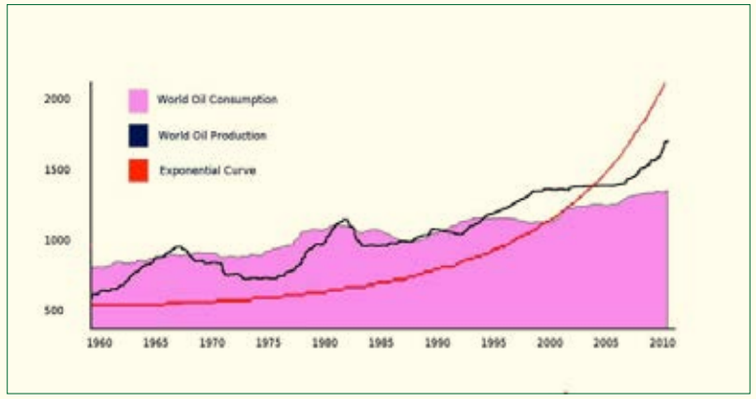
"…But waste not by excess: for Allah does not love the wasters*" (6:141)

{يَا بَنِي آدَمَ خُذُوا زِينَتَكُمْ عِندَ كُلِّ مَسْجِدٍ وَكُلُوا وَاشْرَبُوا وَلاَ تُسْرِفُوا إِنَّهُ لاَ يُحِبُّ الْمُسْرِفِينَ*) (الأعراف: ٣١)

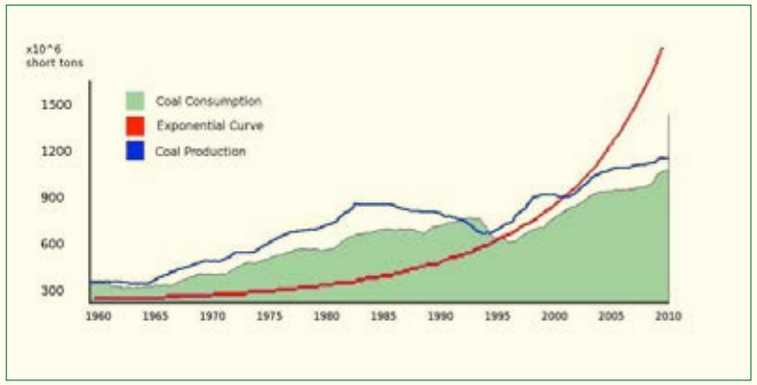
"O Children of Adam! wear your beautiful apparel at every time and place of prayer: eat and drink: But waste not by excess, for Allah does not love the wasters*" (7:31).

{وَالَّذِينَ إِذَا أَنفَقُوا لَمْ يُسْرِفُوا وَلَمْ يَقْتُرُوا وَكَانَ بَيْنَ ذَلِكَ قَوَاماً*} (الفرقان: ٦٧).

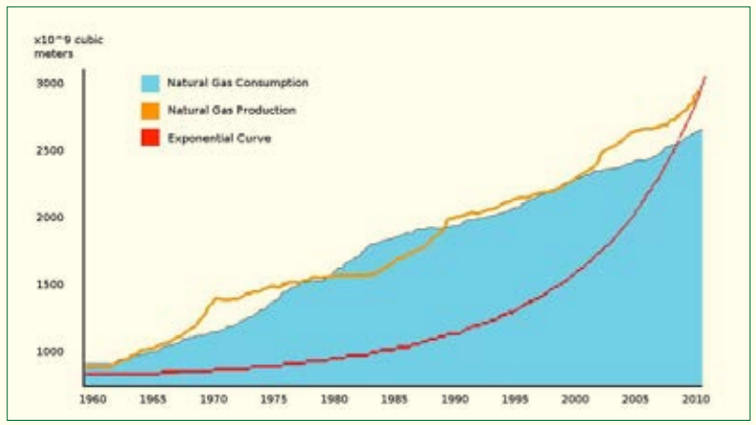
"Those who, when they spend, are not extravagant and not niggardly, but hold a just (balance) between those extremes*" (25:67).



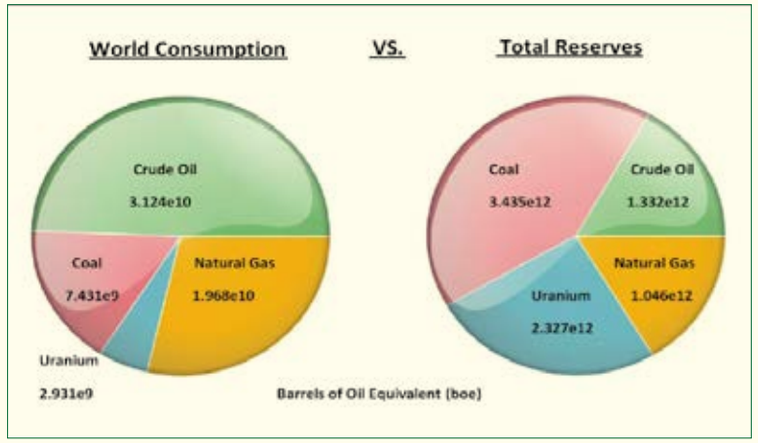
The excessive oil consumption is almost approaching its production which threatens its near depletion.



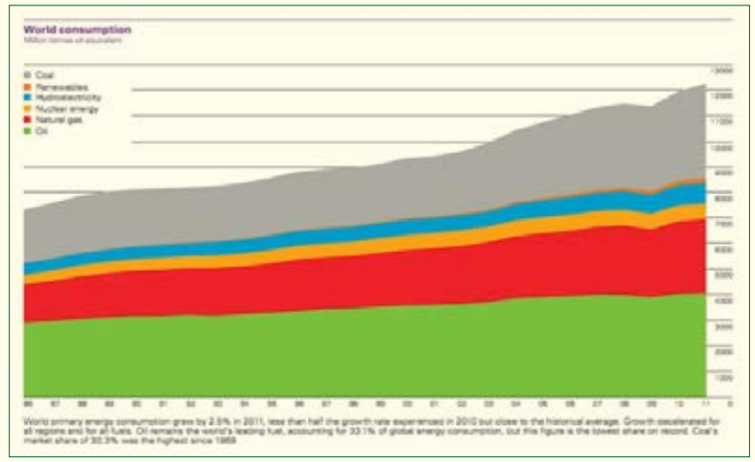
The excessive coal consumption is currently threatening its near depletion.



The excessive gas consumption is almost approaching its production which threatens its near depletion.



Hydrocarbon excessive consumption is currently threatening its near depletion.



The excessive consumption of all energy sources is currently threatening its near depletion.

G. Prophet Mohammad (pbuh) condemns pollution of the earth's environment and establishes strict controls for its conservation:

قال رسول الله صلى الله عليه وسلم: "إن قامت الساعة، وفي يد أحدكم فسيلة، فإن استطاع ألا تقوم حتى يغرسها، فليغرسها".

"If the Last Hour is about to take place and one of you was holding a palm shoot, let him take advantage of even one second before the Hour to plant it".

قال رسول الله صلى الله عليه وسلم: (ما مِنْ مُسلمٍ يَغرِسُ غَرْساً، أو يَزْرَعُ زَرْعاً فيأكُلُ منه طَيْرٌ أو إنسانٌ أو بهيمةٌ، إلاَّ كان لهُ به صَدَقة).

"If a Muslim plants a tree or sows seeds, and then a bird, or a person or an animal eats from it, it is regarded as a charitable gift for him."

قال رسول الله صلى الله عليه وسلم: (كلوا واشربوا وتصدقوا والبسوا، ما لم يخالطه إسراف أو مخيلة)

"Eat, drink, give in the way of Allah and dress modestly, without extravagance or show off".

Consider recycling and fixing before buying new items
When asked about how the Prophet used to live in his house, the Prophet's wife, `A'ishah, said that he used to repair his own shoes, sew his clothes and carry out all such household chores done without complaint or want for more.
The idea behind this was to show Muslims that menial tasks were not degrading for the Prophet. Reusing and repairing things instead of always buying new is not a sign of poverty, they are a sign of power. By performing household duties, the Prophet was saying we can build foundations on less 'stuff', we are in control of what we consume and we don't need more.

Hygiene and cleanliness (tahara) is so integral to Islam that it is actually is a religious obligation on every Moslem.
Without physical hygiene, prayers are not accepted. Without clean facilities pollution ruins cities, and without any effort to improve one's own purity, it becomes more difficult to prevent external corruptions like littering

قال رسول الله صلى الله عليه وسلم: (الإيمان بضع وسبعون أو بضع وستون شعبة، فأفضلها قول لا إله إلا الله، وأدناها إماطة الأذى عن الطريق، والحياء شعبة من الإيمان.

Prophet Muhammad said about street clean-ups, "Removing harmful things from the road is an act of charity.

قال النبي صلى الله عليه وسلم: "ما آمن بي من بات شبعانا وجاره جائع إلى جنبه، وهو يعلم به" .

Abdullah ibn `Abbas reported that the Prophet said, "The believer is not he who eats his fill while his neighbor is hungry."

a person should stop eating as soon as the hunger pangs cease." Nothing is worse than a person who fills his stomach. It should be enough for the son of Adam to have a few bites to satisfy his hunger. If he wishes more, it should be: One-third for his food, one-third for his drinks, and one-third for his breath."

Animals should be cared for

(بينا رجل بطريق، اشتد عليه العطش، فوجد بئرا فنزل فيها، فشرب ثم خرج، فإذا كلب يلهث، يأكل الثرى من العطش، فقال الرجل: لقد بلغ هذا الكلب من العطش مثل الذي كان بلغ مني، فنزل البئر فملأ خفه ماء، فسقى الكلب، فشكر الله له فغفر له). قالوا: يا رسول الله، وإن لنا في البهائم لأجرا؟ فقال: (في كل ذات كبد رطبة أجرا) .

"A man felt very thirsty while he was on the way, there he came across a well. He went down the well, quenched his thirst and came out. Meanwhile he saw a dog panting and licking mud because of excessive thirst. He said to himself, "This dog is suffering from thirst as I did." So, he went down the well again, filled his shoe with water, held it with his mouth and watered the dog. Allah appreciated him for that deed and forgave him." The Companions said, "O Allah's Messenger! Is there a reward for us in serving the animals?" He replied: "There is a reward for serving any living being."

قال رسول الله صلى الله عليه (عُذِّبت امرأة في هرة، سجنتها حتى ماتت، فدخلت فيها النار، لا هي أطعمتها ولا سقتها إذ حبستها، ولا هي تركتها تأكل من خشاش الأرض.

Allah's Apostle said, "A woman was tortured and was put in Hell because of a cat which she had kept locked till it died of hunger." Allah's Apostle further said, (Allah knows better) Allah said (to the woman), 'You neither fed it nor watered when you locked it up, nor did you set it free to eat the insects of the earth."

Conserving the resources:

مر صلى الله عليه وسلم – بسعد بن أبي وقاص وهو يتوضأ فقال (ما هذا الإسراف؟)، فقال: أفي الوضوء إسراف؟، قال (نعم وان كنت على نهر جار)

Prophet Muhammad, peace and blessings be upon him, happened to pass by a companion, Sa'd, as he was performing ablution , the Prophet said, "Sa'd what is this squandering?" Sa'd replied: "Can there be any squandering in ablution?" The Prophet said: "Yes, even if you are by the side of a flowing river."

SUMMARY AND CONCLUSIONS

Man was created and entrusted with the earth as its vicegerent, guardian and steward. Hence, he is allowed to reap its rewards without waste or extravagance, and conserve its environments against mischief, corruption or destruction. This is an Islamic obligation because the earth's environment is so well balanced, that if disturbed it requires a considerable time to adjust. Consequently, conservation has always been part and parcel of the Islamic teachings since the very early days of Islam, while the recent call for the conservation of the environment only started in the latter half of the 20th century.

Islam advocates the dignity of nature, as the work of the Creator, and teaches that it must be well-preserved and protected from any damage. Human beings are deeply interwoven into the fabric of their environments, and hence its corruption will reflect on them.

For the conservation of the environment, Islam teaches the following principles:

1- Allah (all glory be to Him) is the Creator of everything and hence, everything is His possession, and man cannot transgress on the divine property.

2- Allah's creation is perfect and well- balanced, and hence, should never be disturbed.

3- Every form of Allah's creation (animate or inanimate) has a certain degree of sense, feeling, reaction and expression and hence, it knows its Creator, worships and glorifies Him. It can react to defend itself, and its reaction can be harmful to man. By corrupting his ecosystem man is actually damaging himself. Consequently a balanced relationship between man and his environment becomes both a religious obligation and a utilitarian need.

4- Man's responsibility about the earth is over emphasized in all the divine revelations. However, the recent trend of drifting away from religion has developed human selfishness and greed. These are currently destroying all the earth's ecosystems and exhausting its resources. Consequently, corruption of the earth's environment is categorically forbidden in Islam, is prohibited, and is punishable in this world and in the world-to-come:

5- Wasteful extravagance is one of the grave damages to the earth's environment, and is threatening that the depletion of the recourses of the earth is getting very close.

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THE SECOND INTERNATIONAL FORUM
OF THE QUR'ANIC BOTANIC GARDEN
ISLAMIC PERSPECTIVES ON ECOSYSTEM MANAGEMENT

Islamic Practices and Perspectives of Other Religions in Ecosystem Conservation

MUGHAL GARDENS: THE EPITOME OF ISLAMIC VISION OF CONNECTING PEOPLE WITH ENVIRONMENT THROUGH EX SITU CONSERVATION

Dr Sanjay Deshmukh

Dr Sanjay Deshmukh
Professor of Life Sciences
University Dept of Life Sciences, University of Mumbai
Vidyanagari, Santacruz (E), Mumbai 400098, INDIA.
E-mail: docsvd@yahoo.com

1. Introduction

Variety and variability of all forms of life on Earth are included in the definition of Biodiversity as defined by the CBD and it plays a significant role in human existence. Two basic complementary strategies called in situ and ex situ conservation contribute to maintenance, sustainable utilisation and restoration of the lost and degraded biodiversity. Conservation of all levels of biological diversity outside their natural habitats through different means such as zoo's, captive breeding, aquaria, Botanical Gardens and gene banks is called Ex situ conservation, which plays a key role in raising awareness, gaining widespread public and political support for conservation action, communicating the issue and for breeding endangered species (of plants, for example) in captivity for reintroduction.

1.1. Environmental concerns in Mughal era

Culture of any society can be judged by analyzing how environmental concerns have grown in human society and how soon they have become a respectable branch of intellectual history. Environmental concerns can be categorized as (a) anxiety over the surroundings in which we live, a feeling in which the good life of our own species is the principal object; or (b) sympathy for other animal and plant species, in which the protection of other species (at least their preservation) becomes an end in itself. Two different standpoints lead to two concerns, whereby on many occasions, requirements of the one may be found in contradiction to those of the other. However, humanity's own interest in nature with regard to the scientific study of flora and fauna underlies both these concerns. Therefore, it can be said that for any serious concern for the protection of both environment and species, scientific curiosity can be the prerequisite.

2. Biodiversity conservation: Vision of Mughals

Figure: The Mughal Empire and its major provinces (1590 AD).
(Source: Michel Conan, 1999).

Traditional knowledge prevailed in historic times too, and conservation of flora and fauna through development of "resting places" became one of the nobel interests of the Mughal Emperors which indirectly brought them closer to ecology. Establishment of "Gulistan" (Flower Gardens) and orchards and even laying of

Gardens or Parks was a favourite pastime of the Mughal kings, princesses, and nobles. Natural corollary to it was an attempt to introduce new fruit varieties. For example, sweet cherry was introduced in Kashmir by way of grafting by Quli Afshar who was Governor in the regime of Akbar; even quality of oranges in the imperial Gardens was improved by grafting. Philosophy of respecting nature was imbibed in Shahjahan, who generously lifted the ban on grafting, and the grafted oranges began to be widely grown in Mughal Empire in India [Irfan Habib 1996: 129-30]. Those days, tendency of Mughal princes and nobles was to create public Gardens, i.e., "Gardens open to the public". This is an important aspect of Mughal Gardens, wherein the general public was motivated to look at nature's creation by way of organising cultivation of various species from the forests, as well as horticultural species from different parts of the region, in a Garden which today is regarded as "Ex situ" conservation measure. Little attention has been paid to such wisdom of Mughal Emperors so far, which clearly brings out their concern of the Garden-laying to make greenery accessible to the ordinary man.

Public Gardens were laid out in several places by the Mughals, for example, in Burhanpur and Ahmadabad, Abdur Rahim Khan Khanan laid out public Gardens, while the King himself laid another one at Ahmadabad. Princess Jehangira established one at Surat in Gujarat. Even the famous Taj Mahal Garden was also made open to the public [Irfan Habib,1996: 135-137].

While laying out Gardens, the Mughal rulers endeavoured to make them suited to natural surroundings, wherever possible. The paintings of Baburnama (during Akbar's time), depict laying out of Gardens by Babur. Even photographs of the Farah Bakhsh or at Srinagar, Shalamar Garden built by Jehangir. Fidai Khan established original Pinjaur Gardens in the setting of the hills. The following glorious verses of the Holy Qur'an reminds everyone of contribution of nature to one's life and guides him towards commitment to conservation.

I quote:

﴿الذي جعل لكم الارض فراشاً والسماء بناء وأنزل من السماء ماء فاخرج به من الثمرات رزقا لكم﴾

It means: "Who hath appointed the Earth a resting place for you, and the sky a canopy and causeth water to pour down from the sky, and brings forth by it out of the fruits a sustenance for you…" [Al-Baqarah: 22].

2.1. Mughal Gardens:

Cource: Conan, Michel (Ed.). Perspectives on Garden Histories. Vol. 21. Dumbarton Oaks Research Library and Collection, Washington D.C. 30p.

One of the most distinguished chapters in the history of Garden and landscape arts can be seen from the Mughal Gardens constructed in South and Central Asia during the sixteenth through eighteenth centuries. They have often been cast in modern scholarship as a branch of "the Islamic Garden". In survey books on World Garden history, the chapter on Islamic gardens is described following the medieval Gardens, and preceding the chapter on East Asian Gardens of China and Japan, and even Renaissance Gardens of Europe. It is evident from history that since the Mughal Gardens of South Asia paralleled the development of baroque and early modern Gardens in Europe and East Asia, neither of these chronologies makes sense. Records show that there had been a considerable amount of cross-cultural exchange of Garden plants, imagery, and iconography in large measure. Apart from suggestive comparisons of contemporary monumental royal Gardens in Europe and India, and exploratory essays about the Medicis and the Mughals, the global context of Mughal Gardens raises more questions than answers.

2.2. General characteristics of Islamic/ Mughal Gardens:

The main theme of 'Paradise as a Garden' pre-dates the three great monotheistic religions, Judaism, Christianity and Islam, by centuries. The Islamic context Garden, flowing water, shade and exuberant foliage are the key elements which powerfully convey ideas of both spiritual and physical refreshment.

During the Sumerian period in Mesopotamia (4000 BC), i.e., in the first writings known to man, mention of a Paradise Garden for the Gods is found. The Babylonians in 2700 BC (in the Epic of Gilgamesh) described divine Paradise as "In this immortal garden stands the tree … beside a sacred fount the tree is placed".

Water and Shade are the two indispensable elements of the Islamic Gardens of Paradise. Moreover, in a hot desert climate, more than in countries where rain is frequent, desert nomads and city dwellers alike have always viewed water as a direct symbol of God's mercy. The ideas of mercy and water are inseparable and hence in Qur'an, rain is described throughout as a mercy and as life-giving.

The origin of the word 'Paradise' comes from the ancient Persian word 'Pairidaeza' (Petri means around and deaza means wall, thus the word suggests an area isolated from its surroundings, enclosed by walls). Persians are considered as one of the earliest civilizations to cultivate/ develop gardens, parks and hunting grounds. From early on, 'Paradise' became associated with the 'Garden of Eden' even in the Jewish and Christian traditions. Therefore, it can be easily said that during the time of the Prophet Muhammad, the Gardens of Paradise symbolizing the righteous were not a new concept.

In the Holy Qur'an, the most commonly used phrase with regard to Gardens is "Jannat-al-Firdaws" meaning gardens (jannat) of paradise (firdaws). It is said that there are about 122 references of Gardens of Paradise. The word Jannat has also been used to convey a wide range of meaning, which indicates a place not only blissful and eternal, but also a refuge, a sheltered and secure retreat (Khalwa). The spiritual peace and harmony of man's primordial state is described by the term "Gardens of Eden". In addition, the terms 'Gardens of Eternity', 'Delight Bliss', 'Refuge', as well as 'Eden' recur several times on Qur'an, the most frequent being (over thirty times) 'Jannat Tajri min Tahtiha al-Anhar', which means "Gardens underneath which rivers flow".

Sura al-Rahman (Sura LV, "The AllMerciful") in the Qur'an provides the most detailed account of the Gardens of Paradise wherein four gardens are described, which are divided into two pairs. The lowest pair, reserved for "the Righteous", is called the Garden of the Soul and the Garden of the Heart whereas the higher pair - the Garden of the Spirit and the Garden of the Essence is reserved for the "Foremost". It is evident from this description that the four-fold form of the Islamic Garden is thus not just a harmonious and beautiful design but incorporates a complex and profound meaning.

2.2.1. Importance of Number 04 in Islam and the Gardens designed by Islamic rulers around the symbolism:

Figure: THE DESIGN (the rectangular gardens, surrounded by a high red sandstone wall, follow the Persian Chahar Bagh or "Four Gardens' layout. It was brought to India by the first Mughal Emperor Babar)

Even though the universal symbolism reflects the order of the Universe (the four cardinal directions and the four elements), Islam invested this ancient symbolism with a rigorous spiritual vision. The Ka'ba which represents the house of God (Bayt Allah) literally also means 'cube', sums up this symbolism perfectly. As we all know, Ka'ba is the centre of the world, its shape emphasizing the solidity of the earth and the four directions. The part of the rites of the pilgrimage, i.e., circumambularion of the Ka'ba is the circle enclosing the square, the meeting place of heaven and earth.

Among other types of Islamic Gardens, common are 'The Gulistan' (meaning rose garden), 'Bustan' (means formal garden), kitchen-garden or an orchard besides the most general all-embracing term – the 'Bagh'. Here, however, our major focus is on the word 'Chaharbagh', a Persian word literally meaning "Four gardens" where a garden is divided into four quarters (sometimes each quarter is also divided further) by water-channels or pathways, usually with a fountain or pool at the centre.

Sayings of the Qur'an as also Prophet's description of the word 'Miraj' or 'Ascent in to heaven' form strong basis for the Chahar-baghs established by Mughals. It can be seen from layouts of any of the famous Islamic/ Mughal Gardens they are based on number 04. For example, in India, both the Anguri Bagh in Agra (part of the Red Fort) and the Taj Mahal, are both centred on a four-fold design, which is based on the interaction of the circle and the square that symbolize the heavenly and earthly worlds. The open-air sacred architecture of Chahar-bagh, which is analogous to the traditional Arab-Islamic house was thus built on a four-fold plan around a central courtyard.

2.3. Regionalisation of Mughal Gardens:

The concept of Mughal Gardens evolved with the wisdom derived from Central Asian, Persian, Indian, and European Garden traditions. Garden history connections within India were particularly fruitful in Gujarat, Rajasthan, Kashmir, Punjab, and parts of the Deccan. The other angle to passing on the tradition within and between religions/ nations has been the growth of cross-cultural relationships with the waning away of the Mughal imperial centre during the eighteenth century. Co-evolution of Rajput Gardens with Mughal Gardens is one such example and it is attributed to marriages between Mughal rulers and the daughters of Rajput nobles. With declining Mughal powers, development of the Garden impulse took place in the Rajput centres of Marwar, Mewar, Bundi, Kota, Udaipur, as well as in Orchha. Other regions continued to develop.

The Rajput Gardens, while retaining the overall Mughal geometry, were designed to take on selected asymmetrical forms, elaborate parterres, and exquisite water features. For example, hundreds of fountains within the Garden of Deeg were fed by a large, elevated tank. On special occasions, each of the fountains within the Garden which were fed by the elevated tanks which bore several holes, showed its own regulated flow and colour, because coloured powders were placed in these holes. The Rulers had large spherical rocks rolled on the stone roof of his own pavilion at the time of playing of fountains, which simulated the sound of thunder!

One of the most beautiful syntheses of Mughal and Rajput Garden forms can be seen in the hyper-arid Marwar region of Western Rajasthan – the fortress Garden of Nagaur. One of the four Chahar Baughs in the Garden looks rectangular, but is actually of a slightly rhomboid shape while the main Chahar Baugh is square. At the time of establishment, two quadrants were planted while the other two were shallow lotus pools. These Gardens are some of the most exquisitely detailed Garden spaces in South Asia and hence the elegance of these regional variations on Mughal and local Garden design awaits further scholarly study.

Further Characterization of these Eighteenth-century Gardens were marred by increasing articulation of ornamental details and the lacunae in terms of low level of spatial scale and imperial allusion, to be counteracted by regaining aesthetics through heightened intimacy and taste. A glaring example of one of the major centres of eighteenth-century Indo-Islamic Garden design for funerary as well as Palace, and pleasure is the Shiite Courts of Lucknow and Hyderabad which stood out in some cases with their waterfront enhancement. The widespread Gardens of the Deccan region of Southern India were given fresh attention, which included a study of the poetics of Garden scent. Even the most sacred Hindu city along the banks of the holy river Ganges - Varanasi, boasted a few late Mughal Gardens. In some cases, the influence of Mughal Gardens lead to preciously small bulbous domes, overlying reticulated cusped arches, and dramatically carved plastered surfaces that meant to imitate the more costly and elegant marble cladding of earlier times. In the Rajput examples, this trend was artistically successful.

The Sikh residential Gardens in the Punjab add an important chapter to the legacy of Indo-Islamic Garden history; however, the Sikh Gardens in Punjab had a mixed record in these respects. It is evident from the fact that a Garden known as the Hazuri Baugh, sited between Lahore Fort and the monumental Badshahi Masjid of Aurangzeb, is dwarfed by both of these architectural complexes, A Shiite funerary area was developed in Delhi by construction of Gardens which continued to surround the large Tombs of nobles such as Safdarjung and Najaf Khan. This also marked the relative rivalry and ascent of Shiites. Safdarjung's Tomb possessed unusually large water channels, which consumed more water than any of the larger imperial Gardens of the city. Today, the water systems and planting design of Safdarjung's Tomb are in bad shape and have yet to be reconstructed even on a conjectural basis.

3. Evolution of Mughal Gardens: From Design Principles to irrigation methods to aesthetic development:

3.1. Design principles:

The Garden-craft during the Mughal period always possessed bold repetition and breadth of treatment that provided a wonderful fascination and a grand, serene, and peaceful dignity. But these vast Gardens of the plains - as several of them are bereft of their flowers, trees, and water, the edges of their raised stone walks and platforms left with sharp and hard-casting long unbroken shadows in the blazing sunshine- easily degenerate into a tiresome, soulless formality, a tedious reiteration of bare lines,

As Ruskin [Villiers Stuart,1913] pointed out, the very lines which, when partly clothed by their contrast form, provide the best foil to the grace of natural curves in plant and foliage and heighten the enjoyment of the wild luxuriant vegetation. The rapid growth of the vegetation shoots up after the first summer rains, the dancing sway of flowering twigs and the coloured foam of the creepers as they fall in cascades down the trees, which was monotonous and this monotony was the special danger of the Mughal as of other classic styles. This was clearly recognised by the creators, which resulted in development of (a) four Gardens-like Shah-Dara - the four main divisions of the grounds were usually laid out in different ways, and in (b) great Char-Baughs literally.

A custom of consecrating separate squares, or even whole Gardens, to the worship of some special flower was among the other forgotten Charms of Indian Garden-craft. Some examples are:

- The Lala-zar (Tulip-fields) which made such a regal blaze of colour round Samarkand in spring;
- Babar's Violet Garden, near Kabul; or
- The Gulabi Baugh (Rose Garden) at Lahore, with the motto heading this chapter on its entrance gate.

The broad colour masses (of roses) were seen from the raised chabutras, which were backed by the dark trees and looked aesthetically effective. Other species of ornamental plants like Poppies, lilies, and anemones were other flowers that were frequently planted in plots, besides the violets. Among the smaller flowers, were the red cyclamen which were portrayed in coloured marbles round Jehangir's Tomb.

Another form of decorating Gardens was "Nakkashi work", that is the inlaid tiles so largely used in their decoration. To explore the evidences of the zeal of Mughals, one could look at the Tartar tradition wherein Tombs were built in large numbers by them besides great Gardens.

3.2. Irrigation Methods:

Mughal Gardens, in designs, every detail irrigation pattern was meticulously designed and never lost sight of.

The paths within the Gardens were always raised, and even when flower-beds were continuous patterns, let into the paths themselves. The Garden squares are generally two or three feet lower still, and their flowerbeds were planted in a correspondingly bolder way, with rose bushes, fruit trees, and tall-growing flowers and herbs. The large fountain basins and tanks were designed in the same fashion, their corners and sides being ornamented with scrolls of sculptured stone or marble. Broadly speaking, a Mughal Garden is always a sunk Garden, no matter how high or how numerous its Terraces may be. The canals in the upper and lower Terrace of the Lahore Shalimar Baugh are wide, about twenty feet across, and they each have their line of little fountains. There are broad pathways on either hand paved with narrow bricks arranged in herring-bone and various other patterns. In the Punjab, where the land is formed from the silt of the five great river-beds, stone is not easily procurable, so brick-work and tiles are largely used to replace the stone and marble of Delhi and Agra. These brick walks are a great feature at the Lahore Shalimar, and are particularly interesting as so many other Mughal Gardens have lost all trace of the stones which paved their paths and causeways.

The pavilions overlooking the water are inferior modern restorations, in brick and plaster; the Sikhs in the eighteenth century having despoiled the Gardens of most of the splendid marble and agate work to ornament the Ram Baugh at Amritsar. One water pavilion alone, called, like those in the Delhi fort, Sawan Bhadon, gives some idea of Ali Mardan Khans original work. Through this pavilion the water of the large tank empties itself, filling the canals of the lower Garden. Moorcroft [Nadhar Shahbaz Naeem,2010] who visited Lahore in 1820, gives the following description of this Bara-Dari: 'There are some open apartments of white marble of one story on a level with the basin, which present in front a square marble chamber, with recesses on its sides for lamps, before which water may be made to fall in sheets from a ledge surrounding the room at the top whilst streams of water spout up through holes in the floor.' At Alwar, in an old Garden pavilion belonging to the Maharaja, a similar device exists for cooling the rooms-a row of small jets is placed under the cornice outside the pavilion, so that the whole building can be veiled in a fine spray of water.

3.3. Aesthetic development: Botanical perspective

From the Mughals themselves, we know that their Gardens were full of flowers, fruits and trees of all kinds. The love of trees became a passion with the Mughals. Contemporary sources are their memoirs, their paintings, and plants and flowers of every kind in the inlays, carvings and mural paintings of their buildings. The *memoirs of Babur and Jehangir, the Ain-i-Akbari are* filled with details of their Gardens. While much research is still needed to identify with certainty many of the plants (nearly 100 or so) to which they referred, it is possible to build up a fairly general picture of the plant materials they used. Some information too is available from European travelers in the Mughal Empire. In the present research work, a survey of the existing *Mughal Gardens* in Agra along with survey and identification of the plant species grown at present is made. We have also concentrated on art and architecture in various Mughal buildings depicting various plant material used during the time of Mughals. First of all for layout designing and architecture of the Mughal Gardens we must look back at their *Persian and Indian backgrounds* as the *Garden* in Islamic Style of architecture where Garden is symbolic of *paradise*. An enduring part of Persian art and tradition was the *paradise-park* or the *paradise Garden*, a concept which goes far back into history and which was linked from the earliest times with a deep love of trees and flowers. The basic design of the paradise Garden was very simple. It was an idealized form of the pattern of irrigation, in which water is shown symbolically and physically as the *source of life*. These quarters may also be filled with trees and flowers. Sometimes the trees extend at each side of the *Garden* to form a park or woodland surrounded by a wall to keep out the surrounding desert with its dust-laden winds and to give privacy and protection

4. Gardens of Mughal Provinces:

4.1. Mughal Gardens of Afghanistan:

4.1.1. Baugh-e-Babur

Location: Kabul, Afghanistan
Established: 1528 AD

Source: vagabondteacher.tumblr.com

Architecture: This 11-hectare Terraced Garden is located on the Western slopes of the Sher-e Darwaza Mountain, which is South of Kabul, Baugh-e-Babur Garden has been the final resting place of the first Mughal Emperor, Babur. The headstone placed on his grave reads "If there is a paradise on Earth, it is this, it is this, it is this."

The Garden was laid out as series of 15 stepped Terraces and its axis points toward Mecca. The Terraces descend Westward towards the Kabul River. The overall layout of the Garden is rectangular in plan, with an extension containing a caravanserai and another containing the burial Terraces at the foot and head of the central axis.

Babur's grave is located on the fourteenth Terrace and was originally surrounded by a screen of white marbles. Towards the South -West end of the Garden on the lower Terrace of the grave, Shah Jahan built a small mosque. Water channels that flow through the central axis of the Garden and further a caravansary marketplace is added at the base of the Garden. On the fifteenth level, there is a Tomb with a marble screen of Babur's grand-daughter Ruqaiya Sultan Begum.

In 1880, the local ruler Amir Abdurahman Khan refurbished the Gardens in a style that were influenced more by European tastes than Mughal precedence. He added a central pavilion and a large residence, now called the Queen's Palace, for his wife Bibi Halima. Nadir Shah later converted the Garden into a public park by constructing pools, reservoirs, and flower Gardens down the central axis of the landscape. In the 1980's a modern swimming pool and greenhouse were constructed.

Warfare between competing factions in Kabul, mines and unexploded munitions have turned the Garden into a dangerous "No man's land". In 2011, the Garden was completely restored – thanks to the efforts of the UNCHS, Habitat, and the Aga Khan Trust for Culture. The present Garden now measures about 300m at its widest and 460m at its longest.

4.2. Mughal Gardens of Pakistan:

4.2.1. Chauburji

Location: Lahore, Pakistan
Established: The Garden is attributed to Mughal Princess Zeb-un-Nisa, 1646 AD

Source: www.panoramio.com

Architecture: One of most famous monuments of the Mughal era is Chauburji. It represents a strong blend of Mughal architecture with ancient Muslim style of building. Its gateway consists of four Towers and contains much of the brilliant tile work with which the entire entrance was once covered. The distinguished features of the Garden are the Minarets which expand from the top, not present

anywhere in the sub-continent and arches which are of the so-called 'Tudor' style. Originally, Chauburji was gateway to the Garden of Zeb-un-Nisa or Zebinda Begum. The Garden was extended from Nawankot in the South to the main city of Lahore towards North. However, no traces of such an expansive Garden are now available. The main purpose of building Chauburji appears to be strictly monumental.

4.2.2. Palace Gardens of Lahore Fort

Location: Lahore, Pakistan
Established: 1556–1605

Lahore Fort: Garden of the Diwan-e-Aam Quadrangle

Lahore Fort: Garden of the Jahangir's Quadrangle

Lahore Fort: A bird's eye view of Paien Bagh and garden of Shahjahan's Quadrangle

Architecture: The Lahore Fort had a unique ensemble of buildings, structures and green areas that depicted trends and tastes of different rulers. The present shape of the fort indicates that it was then served as a residential Fort rather than a military Fort.

As it can be seen today, there are at least four well-laid Gardens in the Lahore Fort they are:

In front of the Diwan-e-Aam

Within the quadrangle of Jehangir

Between the Chhoti Khawabgah and Diwan-e-Khas

The Harem Garden.

In front of the Diwan-e-Aam: A huge vast open landscape Garden of the Chahar Baugh style was established with fountains and a large tank was made in front of Diwan-e-Aam.

Within the quadrangle of Jehangir: To the front of Jehangir's Palace is this Garden having in the middle of the square, a marble reservoir with numerous fountains and therefore was then called as Jehangir's Quadrangle.

Between the Chhoti Khawabgah and Diwan-e-Khas: The court adjoining Jehangir's quadrangle was occupied by a Garden, which was laid out again in the formal Chahar Baugh style. It contains a central platform of marble having a fountain in its centre. The greens have been intersected by the usual pathways, which were

provided brick-on-edge pavement during their restoration work in 1997. On the Northern side of this Garden lies the famous Diwan-e-Khas, built in chaste white marble. Towards its South was the Chhoti Khawabgah, the frontal of which now stands reduced to mere foundations.

The Harem Garden (Paien Baugh): Maharaja Ranjit Singh, was responsible for development of a small, nonetheless attractive, Garden known as Paien Baugh in East of the forecourt of the Sheesh Mahal. It was meant for ladies of the Harem residing in the Sheesh Mahal. It was enclosed on all the four sides by corridors similar to the Chahar Baugh style. The central place of the Garden contained a brick-platform and a water tank with fountain. On either side were provided smaller water tanks enclosed by red sandstone railing. The Garden still has a four-fold plan with brick-on-edge pavement intersecting the grassy portions. There are three fountains in Garden, one in the centre of the platform and the other two on its either sides.

4.2.3. Shahdara Baugh

Location: Lahore, Pakistan

Architecture: Nur-Jahans Garden of Delight is called Shah-Dara Baugh and is featured by many Gardens and *serais* (inns).

Source: shahdaralahore.blogspot.com

In the early Mughal period it served two functions, one of which was the hunting ground of Sheikhupura and the other was retained as a recreation zone. Shahdara contained royal Tombs of the Mughal Emperor Jehangir, his brother-in-law Asaf Khan and his wife, Nur Jahan within close proximity to each other. These three Tombs and serai are built in a unique style wherein one Garden dominates the entire area, and the spatial relationships among Gardens are less

evident. The entrance of the Garden is through a serai courtyard. The courtyard is square with high gateways and a series of arched alcoves opening on to a wide Terrace running all round the walls. The Tomb is in the centre of the second enclosure. The Gardens are very large and are raised by series of fountains tanks which form the eight large chabutras encircling the mausoleum.

The Tombs are bordered by long parterres lately replanted with Cypress trees and flowers. Climbing plants are well established, and wreath the walls and alcoves with graceful garlands.

4.2.4. Shalimar Gardens

Location: Lahore Pakistan

Established: 1641 AD

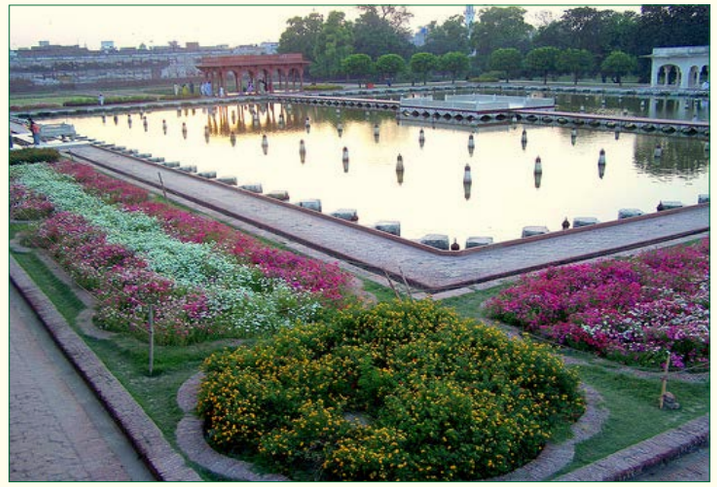
Source: www.fanpop.com

Architecture: It is believed that Shalimar Gardens draws its inspiration from Central Asia, Kashmir, Punjab, Persia, and the Delhi Sultanate. They were laid out in an oblong parallelogram, surrounded by a famous intricate fretwork high brick wall which measures 658m North to South and 258m East to West. The Gardens were laid out from South to North in three levels of Terraces and were elevated by 4–5m above one another. The respective names of these three Terraces are as follows:

- The upper level Terrace was named Farah Baksh meaning BesTower of Pleasure,
- The second Terrace was named Faiz Baksh meaning BesTower of Goodness, and
- The lower level Terrace was named Hayat Baksh meaning BesTower of Life.

There were 410 fountains which rose from basin and canals which flowed into wide marble pools. The fountains provided relief to the visitors during blistering summer as they rendered a cooling effect in the surrounding area. The distribution of the 410 fountains is as follows:

- The upper level Terrace has 105 fountains,
- The middle level Terrace contains 152 fountains and
- The lower level Terrace has 153 fountains.



Source: www.flickr.com

The Gardens also had five water cascades including the great marble cascade and *Sawan Bhadoon*. There were various buildings in the Garden which included *Sawan Bhadun pavilions, Aramgah or Resting place, Khwabgah* or Sleeping chambers: *Khawabgah* of Begum Sahib or Dream place of the Emperor's wife, *Hammam* or Royal bath: *Bara-Daries* or summer pavilions to enjoy the coolness created by the Gardens' fountains, *The Aiwan* or Grand hall: *Diwan-e-Khas-o-Aam* or Hall of special and ordinary audience with the Emperor and *Naqar Khana* and its buildings: Two gateways and Minarets in the corners of the Gardens.

The creativity of the Mughal engineers in constructing the Garden is highly creditable. Even today scientists are unable to fully comprehend the water systems and thermal engineering from architectural blueprints

4.2.5. Hazuri Baugh:

Location: Lahore, Punjab, Pakistan,
Established: built by Maharaja Ranjit Singh, a Sikh Ruler in 1818

Source www.snipview.com

Source www.snipview.com

Architecture: Hazuri Baugh Garden is bounded by the Lahore Fort (on the Eastern side), Badshahi Mosque (Western side), the Samadhi of Ranjit Singh (Northern side) and the Roshnai Gate (Southern side). In the centre stands the Hazuri Baugh Bara-Dari. The Bara-Dari was made of white marble which was plucked out from the various Tombs such as of Zaib-u -Nisa (Nawan Kot), Shah Sharaf (Bhati Gate), Tomb of Nur Jahan, Tomb of Asif Jah and Tomb of Jehangir. Its

pavilion had twelve arches and they form an arcade. It was built entirely in white marble, including the frames of the arches. The central area has a mirrored ceiling.

4.2.5. Jehangir's Tomb:

Location: Lahore, Pakistan
Established: Shah Jahan, 1627-37

Source:www.summitpost.org

Architecture: The Mausoleum was rested on a vast quadrangle measuring approximately 500 meters to a side and was subdivided into four Chahar Baughs. At the centre of each Chahar Baughs there was a fountain and the avenues in between created a ring of 8 fountains around the central Tomb. The mausoleum centre was nothing but, an octagonal Tomb chamber, about 8 m in diameter and was connected to the outside of the Tomb by four hallways facing the four cardinal directions. The cenotaph at the centre was carved from a single slab of white marble and decorated with Pietra dura inlayed of the 99 attributes of God. At its foot was an inscription in Persian recording that "This is the illuminated grave of His Majesty, the Asylum of Pardon, Nooruddin Muhammad Jehangir Padshah 1037 AH". The said inscription is still there today.

Today, the Tomb of Jehangir holds special significance for Pakistanis as it is the only Mughal Tomb located in present-day Pakistan. Its image appears on the 1,000 rupee banknote and it remains one of Lahore's most popular attractions.

4.2.6. Mughal Garden Wah

Location: City of Wah, Punjab, Pakistan
Established: 1542-1605

Source: spreebird.blogspot.com

Source en.wikipedia.org

Architecture: The Mughal Garden Wah was an elaborated Garden with clear, rushing water and greenery. It was famous for its spring and shrines. Initially these Gardens were used as transit camp by the Mughal Emperors, but due to their beautiful scenery, valleys and natural water falls, the area was developed and cultivated with magnificent trees and water channels. The Garden depicted beautiful example of love with nature. The Gardens had two Terraces, the upper and

lower. These were famous for its beautiful ponds, reflecting pools, water channels, cascades and fountains.

The Garden had beautiful twelve door structures called "Bara-Dari" twelve (Bara) doors (Dari). The interior walls of these Bara-Dari were embellished with stucco traceries depicting fruits, vases, foliage and trees. The water from clear, cool springs from nearby mountains, used to get collected in a large square tank on the upper Terrace. The flow of the water was through the Bara-Dari and two flanking pavilions. One of the pavilions was nothing but the elaborated bath chamber (Hammam) which was an inclined cascade decorated in black and yellow marble chevron pattern. The flow of the water continued along the cypress lined Garden axis, through a central water tank and platform, and ultimately reached the main entrance gate of the Garden. To the Southern of this Bara-Dari there were seven watch towers and bathrooms having a mixture of cold and hot water.

In the old days this Garden was declared to be a 'Trustee of heaven' and substitute for heaven's Garden on Earth.

4.2.7. Hiran Minar

Location: Lahore, Pakistan
Established: built during the reign of Mughal Emperor Shah Jahan

Source: en.wikipedia.org

Source: infopediapk.weebly.com

Architecture: Hinar Minar was one of the best known and most beautiful hunting complexes. When constructed, it was large and almost a square tank with an octagonal pavilion in the centre. At each corner of the tank, a small square building and a subsurface water collection was used to supply water to the tank. The centre of each side of the tank had a brick ramp that sloped down to the water which was used to provide access for royal animals and wild game. A causeway with its own

gateway was used to connect the pavilion with the mainland and as well as with a 100 foot *high Minar*, or Minaret. This Minar was named as Mansraj and was built by Emperor Jehangir to honor the memory of his pet hunting antelope. The top of the Minar was supposed to be the best place which gave one, feel of a broader landscape. The top North side of the Minar, one could see a patch of forest which was similar to the scrub forest vegetation of Mughal times, while to the West were extensively-irrigated fields. The most unique features of this complex were the antelope's grave and the distinctive water collection system.

4.3. Mughal Gardens of India:

4.3.1. Humayun's Tomb

Location: Delhi, India
Established: Humayun's Persian wife, Hamida Begum, supervised the construction from 1562-1572.

Source: www.tourmyindia.com

Architecture: Humayun's Tomb is the first significant example of the Mughal architecture with high arches and double dome, which occurs for the first time in India. Humayun's mausoleum was the first Garden built in 1562-1572 AD in Delhi. It is located in the middle of a geometrically arranged Garden which, was divided into 36 squares by a grid of water channels and paths. The shape of the Tomb is octagonal placed over a platform with colonnades. It has a great central chamber which has four offsets, double storied in height and with arcade on their facades. It has three emphatic arches each side, the central one is the highest. The Tomb is crowned by 42.5 m high colossal double dome. The structure is built mainly with red sandstone along with use of white and black marble to relieve

the monotony. A Char Baugh is created by enclosing the square Garden by a high rubble wall which, is divided initially into four large squares separated by causeways and channels. Each square is then further divided into smaller squares by pathways. The entry to the Tomb is through a long axial processional track.

UNESCO's aptly listed Humayun's Tomb as its World Heritage Sites. The Aga Khan Trust has since then been providing funds for the restoration of the Tomb. Water has again started flowing from water channels and fountains.

4.3.2. Taj Mahal Garden

Location: Agra, Uttar Pradesh, India.
Established: Commissioned in 1632 by the Mughal Emperor Shah Jahan

Source: jmaser.us

Architecture: Taj Mahal Garden was built in Islamic style of architecture, and it symbolizes spirituality. The Garden filled with flowers, fruits, birds, leaves, symmetry, and delicacy, served many functions along with portraying strong symbolic or abstract meanings about paradise. The Garden spreads all the way up to the plinth of Taj Mahal covering a total area of 300m x 300m. This Garden is based on geometrical symmetry and measurements called as Char Baugh, water plays a key role.

This Char Baugh style divided the Garden into four equal squares, evoking the image of Islamic Paradise that has four rivers of water, milk, wine and honey. The entire Garden was divided into four parts, with two marble canals studded with fountains crossing in the centre. In each quarter portion, there were 16 flowerbeds that were divided by stone-paved raised pathways. It is said that even each

of the flowerbed was planted with 400 plants. The trees of the Taj Garden were either that of Cypress trees (*Cupressus sempervirens*) (signifying death) or of the fruit bearing type (signifying life) arranged in a symmetrical pattern. Between the Taj and its gateway, was a raised marble lotus-tank with a cusped border, which reflected the Taj in its waters. The Garden was organized and laid out in such a manner that one can get an unhindered view of the mausoleum from any spot.

These aesthetically maintained Gardens not only brought a natural sense to the proceedings, but also made for some great snap taking spots.

4.3.3. Ram Baugh

Location: North-East of the Taj Mahal in Agra, India
Established: Mughal Emperor Babur in 1528

Source: www.timesofindiatravel.com

Architecture: The popular and the first beautiful Garden of the Mughals that was built in India is the Ram Baugh Garden. It is famous for its unique style of design and attractive layout that depicts the love of the Mughal for natural beauty.

It is a Persian planned Garden that follows the Char Baugh pattern. As it is situated on the bank of river Yamuna, main theme of the Baugh is Water. The Baugh has four main sections which are crisscrossed by waterways and pathways. The water drawn from the river is then distributed throughout the park in a cascade which is built over three Terraces.

The three level pattern of the Garden comprised of the flowers and vegetables on the first level; flower beds on the second; and tanks and Terraces on the third one. The Garden was built to entertain the Emperor's guests and also for the relaxation of the Emperor and his loyal people

4.3.4. Mehtab Baugh

Location: Agra, Uttar Pradesh, India.
Established: 1631-1635 A.D founded by Babur

Source: www.industrialvisit.org

Architecture: Mehtab Baugh Garden is also called as "A Moonlit pleasure Garden". It is the last of eleven Mughal built Gardens opposite Taj Mahal and the Agra Fort. The Garden is a typical square, cross-axial plan with a square pool in its centre and measures about 300m x 300m.

The Mehtab Baugh was ingeniously planned. It contained a large brick masonry octagonal tank the border of which was made up of 16 scalloped arches. Spacious 'Banglas' were interconnected by wide 'Dalans' or covered corridors, on other sides of the South, West, North and East sides. All the structures were built of red sandstone and engrailed (cusped) arches, pillars and carved panels. There were 25 fountains in the tank. Water flowed there from the main octagonal tank and fell into an oblong Redstone tank in the form of a waterfall (Abshar) on the Northern side. Behind this tank was Achini-khanah (series of niches for candles in the night and flower guldastas in the day). Towards the Northern side was a large Char Baugh, with a square lotus tank in the centre with scalloped corners. There were Bara-Daris (open, arcaded pavilions) on the Western, Northern and Eastern sides of the Char Baugh.

It was laid out in perfect symmetry and alignment with the Taj Mahal and was an integral part of the original design of the Taj Mahal. it seems to have been named 'Mehtab Baugh (the moon Garden) because it is an ideal place for viewing the Taj Mahal in moonlight.

4.3.5. Tomb of Safdarjung

Location: New Delhi, India
Established: 1754

Source: www.indiamart.com

Architecture: Safdarjung's Tomb is described as "the last flicker in the lamp of Mughal architecture". It is sandstone and marble mausoleum built measures 50 meters on each side in 1754 for the statesman Safdarjung. It was planned and built like an enclosed Garden Tomb in line with the style of the Humayun's Tomb. The main entry of the Tomb had a very elaborate ornamentation and was in ornate purple colour. It had an inscription in Arabic on the surface whose translation read "When the hero of plain bravery departs from the transitory, may he become a resident of God's Paradise". After entering through the gate, one could see at the rear side of the façade, many rooms and the library. To the right of the gate was a three domed Mosque marked with stripes.

There were four polygonal shape Towers which were provided with kiosks to around the main Tomb. The central square shaped partition had eight chambers with a Cenotaph in the middle. The Towers or Chatris were of octagonal shape and consisted of four pavilions with multiple chambers. There was an underground chamber in the Mausoleum which housed the graves of Safdarjung and his wife. The dome was more elongated; and the Central part had a taller Pishtaq.

The Tomb had four key features such as:

- The Char Baugh Garden plan with the Mausoleum at the centre;
- A nine-fold floor plan;

- Five part façade; and
- A large podium with a hidden stairway.

The Garden surrounding the Tomb had an area of 2,952 square feet and was in the form of four squares with wide footpaths and water tanks. These were further subdivided into smaller squares. The pavilions were laid out in the Western, Northern and Southern directions and were named Jangli Mahal (Palace in the forest), Moti Mahal (Pearl Palace) and Badshah Pasand (King's favourite), respectively.

4.3.6. Shalimar Baugh (Garden)

Location: NorthEast of Dal Lake, near Srinagar city in the state of Jammu and Kashmir
Established: 1616 by Emperor Jehangir for his wife Nur Jahan

Source: www.britannica.com

Architecture: The Garden shows adaptations of Islamic Garden layout known as Persian Gardens. The Garden covers an area of 12.4 hectares (31 acres) built with a size of 587 metres (1,926 ft) length on the main axis channel and with a total width of 251 metres (823 ft). It is has a four radiating arms with the centre location as the water source. Modifications were done to meet the requirements of the hilly terrain and availability of a well, which could be diverted from a higher elevation to the planned Gardens. This change led the central channel known as Shah Nahar, main axis of the Garden, running through the Garden axially from top to the lowest point.

The Garden has three Terraces fitted with fountains and Chinar tree-lined vistas. The Shahnahar is the main feeder channel to all the Terraces.

Each one of the three Terraces has a specific role.

The architectural details of the three Terraces of the Garden are elaborated below:

The first Terrace is a public Garden which ends in a Diwan-e-Aam (public audience hall). In this hall, a small black marble throne was installed over the waterfall.

Along the axial there is a slightly broader second Terrace Garden. This has two shallow Terraces. For the noblemen and guests of the court, a Diwan-fa-Khas is made accessible. The Diwan-e-Khas, the Diwan-e-Aam, and the Zenana Terrace fountain pools are in succession containing of 410 fountains.

In the third Terrace, the axial water channel flows through the Zenana Garden, this is flanked by the Diwan-e-Khas and Chinar trees. There are two small pavilions at the entrance of this Terrace that restricts the entry zone of the royal harem. In the Zenana Garden a black marble called Black Pavilion is laid by Shahajahan. This Black Pavilion is encircled by a fountain pool that receives its supply from a higher Terrace. There are two smaller, secondary water canals lead from the Black Pavilion to a small Bara-Dari. The two octagonal pavilions above the third level indicate the end wall of the Garden. The Bara-Dari has a lovely backdrop of the Snow Mountains, which is considered a befitting setting for the Baugh.

The unique features of the Shalimar Baugh are its Chini Khanas, or arched niches, behind Garden waterfalls. These niches are lighted at night with oil lamp, which gives a fairy tale appearance to the water falls.

Due to the colour change in leaves of the famed Chinar trees, the Garden is considered to be very beautiful during the autumn and spring seasons. In the top Terrace of the Shalimar Baugh, has the famous inscription in Persian, which says*: Agar Firdaus bar rōy-e zamin ast, hamin ast-o hamin ast-o hamin ast.*

This is a couplet by the Persian poet Amir Khusrau, Translated to English, it means.

"If there is a paradise on Earth, it is here, it is here, it is here.

4.3.7. Nishat Baugh

Location: Close to Srinagar in the state of Jammu and Kashmir
Established: 1633 by Asif Khan, elder brother of Nur Jehan

Source: commons.wikimedia.org

Architecture: 'Nishat Baugh' means "Garden of Joy," "Garden of Gladness" and "Garden of Delight." It is laid out in broad cascade of Terraces lined with avenues of Chinar and cypress trees, which starts from the lakeshore and reaches up to an artificial façade at the hill end. Nishat Baugh belonged to a man, a noble of Mughal Emperor Court. The source of water supply to the Gardens is the same as Shalimar Baugh.

The Baugh was constructed in an East-West direction; the lowest Terrace was connected to the Dal Lake while Zenana Garden was located at the Top Terrace. A 4-metre wide Central canal with water depth of 20 centimeter ran from the top end through the Garden.

The flow of water was cascade from the top to the first Terrace at the road level, which could be also approached from the Dal Lake through a Shikara ride. The water flowed from one Terrace to the next over stepped stone ramps that provided the sparkle to the flow. All the Terrace fountains with pools were provided along the water channel.

Nishat Baugh had twelve Terraces representing twelve zodiacal signs rising from the edge of the Dal Lake. The details of twelve Terraces are provided below:

A water collection chamber is the first Terrace that is also linked to the side flow from the Garden.

The second Terrace has five fountains which receive water from the third Terrace and are accessed through a gate.

The third Terrace has a water chute with five arched open niches in the front and similar niches on the sides. Stairways, on either side of the channel lead to the third Terrace, which has a square chamber with five fountains. Moving up on either side of the channel, leads to the fourth Terrace.

The fourth Terrace has two levels, namely a water channel and a square pool. Stairways with 7 steps lead to the fifth Terrace.

In the fifth Terrace a stone bench is provided across the channel to enjoy the scenic beauty. It also has a square chamber with five fountains.

The sixth Terrace contains two levels with five fountains and distinctive paving pattern.

The seventh Terrace, where the same pattern continues.

The eighth Terrace is only a water channel or chute.

There is an octagonal bench at the end of two stairways of the ninth Terrace. The pool in this Terrace has nine fountains.

Water chute is provided with fountains along the side retaining walls at the stairways to the tenth Terrace.

Twenty-five fountains in a pool and engraved paths lead to an impressive eleventh Terrace. Up from this dramatic Terrace, is the last one.

The twelfth Terrace is the Zenana chamber covered in the front by 5.5 metres high wall with a façade of blind arches. Only one arch in this blind facade provides an opening to the twelfth Terrace. The views of the lower level Terraces are provided by two small octagonal Towers on either side of the retaining walls. It has a two-storey pavilion here surrounded by a lovely Garden with lush plantings.

4.3.8. Pinjore (Yadavindra) Gardens

Location: Pinjore, Panchkula District of Haryana, India
Established: it was created in 17th century by architect Nawab Fidai Khan during the early reign of his foster brother Aurangzeb

Source: haryanatourism.gov.in

Architecture: Pinjore Gardens were renamed as 'Yadavindra Gardens' in the memory of Maharaja Yadavindra Singh, former King of the princely state of Patiala. This Garden is an ideal example of Mughal Garden style. The Garden consists of seven Terraces with its main gate opening into the highest Terrace, i.e., the first Terrace.

The description of the seven Terraces is as follows:

- The highest first Terrace has a Palace built Rajasthani-Mughal style called as "Sheesh Mahal" (Palace of glass), which is adjoined by a romantic "Hawa Mahal" (airy Palace).
- The second Terrace has a Palace called as "Rang Mahal" (painted Palace) with arched doorways.
- Cypress trees and Flowerbeds leading to dense groves of fruit trees make the third Terrace of the Garden.
- The next Terrace is called as the "Jal Mahal" (Palace of water), which has a square fountain -bed and a platform to relax.
- Fountains and tree groves are provided in the next Terrace.
- The lowermost Terrace is an open-air theatre – a disc-like structure. A zoo has also been developed, which adjoins the Gardens. The Garden and the temple complex are in the open air Museum. They are integrated through well laid out and well-drained pathways which gives the whole complex a beautifully illuminated gaze.

The major attractions of the Gardens are Mango festival and Baisakhi (Spring) festival. To get appropriate attention to all the monuments, the Gardens in the complex have been accorded a heritage status.

4.3.9. Khusrau Baugh

Location: Allahabad Junction Station, in Allahabad, India.
Established: 1622

Source: www.propertydirection.com

Architecture: It is a walled Garden with three sandstone mausoleums which represent an exquisite example of Mughal architecture . The first Tomb is that of Sultan Begum. It was a three storied Terrace plinth without a main mound and had a large Chhatri. The Tomb was decorated with Arabesque inscriptions. Next to the Begum's Tomb is the most elaborate Tomb of Khusrau's sister, Nithar. This Tomb was laid on a elevated platform and was bejeweled with panels depicting the scalloped arch motif. The rooms ceiling within this were elaborately painted with stars in concentric circles. The central room had on its walls, floral decorations depicting Persian Cypresses, wine vessels, flowers and plants. The last Tomb in Khusrau Baugh was of that of Khusrau himself. This Tomb had fretwork windows and the Tomb of his mare was laid near his own. This Garden has now lent its name to the surrounding locality of Khusrau Baugh.

4.3.10. Brindavan Gardens

Location: Karnataka, India
Established: 1932

Source: pixshark.com

Architecture: The Brindavan Gardens are one of the most beautiful Terrace Gardens in the World. They have a symmetric design and are modeled in the Mughal style with a number of Terraces, parterres, fountains, running and cascading water channels, water chutes, lush green lawns, flower beds, shrubs and trees. The Garden which is laid out in 60 acres, had three Terraces, which ended in a horseshoe shape. The Garden was enriched with slopes planted with colourful Bougainvilleas and ornamental plants with innumerable musical and dancing fountains coupled with colored lighting. The Garden was divided into four areas as Brindavan Gardens, Government fruit Orchard, Naguvana and Chandravana. Of these, the Brindavan Gardens were divided into the main gate area, South Brindavan, North Brindavan and Childrens' Garden. The main gate area resembled the India Gate of New Delhi. Other attractive features such as Rose Gardens, attractive lawns, annual flowerbeds, perennial flowering plants and ornamental hedges were on either side of the gate.

The South Brindavan near the Cauvery Statue had big sized water fountains. Distinct styles of Terrace Gardens were maintained there. On the slopes of the Terraces Bougainvilleas were grown. The Terrace Garden had a lawn in which Cypresses were planted in the centre while annuals and perennial flowerbeds and ornamental hedges were grown towards its periphery. The Terrace also had many fountains and Dwarf statutes. The fountains were maintained by the water

pressure that sprinkled water always. In India, it is still considered as the most spectacular Garden as it has it fountains with different coloured lights for illumination. For propagation and maintaining different types of ornamental plants a Glasshouse is used. It has a collection of Cactii and succulents which cater to the needs of planting material for the Garden as well as for sales.

The third section of Brindavan Gardens is the North Brindavan, which consists four extensive Terraces. These Terraces have extensive lawns, ornamental annual and perennial flowerbeds, rows of ornamental trees beautified with small fountains. They are also decorated with lights of various colours. The Garden contains tree avenues of Sago Palm, Copper pod, and *Polyalthea* that run parallel to the main road leading towards the Dam. The pathway on either side of the Garden is covered by Arches of Bougainvilleas and *Bignonia venusta.* The slopes of the Terraces have shrubs of *Bougainvillea, Allamanda, Bignonia magnifica*, as well as *Homskloidia sanguina*. It also maintains an ornamental plant nursery for multiplication and maintenance of plants for sales. Located beside the South Brindavan is the Childrens' Park. The park has slide, concrete animals, birds and aquatic species and items/structures for children to play.

Besides this, the Brindavan Gardens have three farms of which the first is known as a fruit orchard farm developed with the aim of producing quality-planting materials of fruits and high yielding hybrid coconut seedlings. The fruits and plantation crops grown in this Garden include several species of Mango, Guava, Sapota, Litchi, Roseapple, Bilimbi, Aonla, Avacado, Malayan apple, Areca nut, and Coconut, etc. The second farm is the Naguvana Horticulture Farm with various types of fruits plants and coconut trees. The third farm is Chandravana Horticulture Farm where Coconut and mango are grown.

4.3.11. The Presidental Gradens

Location: New Delhi, India
Established: 1911-1931 designed by Sir Edwin Lutyens

Source: www.fullstopindia.com

Architecture: One of the most beautiful Gardens of the World is the Mughal Gardens of Rashtrapati Bhavan. This 15-acre Mughal Garden is considered as soul of the Rashtrapati Bhavan. The Mughal Gardens comprise of the following Garden parts:

Rectangular Garden: Adjacent to the main Rastrapati Bhavan (the official residence of the President of India) is the first Rectangular Garden which is divided into four quarters, each with Terraced Gardens on either side. The Rectangular Garden has several flower beds with bulbs that flower in winter and with a prominence of variety of Roses when these are at full bloom. They are centres of attraction. The rose varieties include Adora, Mrinalini, Taj Mahal, Modern Art, Oklahoma, John F. Kennedy, Virgo, Mr. Lincoln and Folklore. In addition, herbs of Dahlias, Tulips, Asiatic Lilies, Daffodils, Ranunculus, Hyacinth and several other seasonal flowers are suitably incorporated add beauty to the Garden. The central part is followed by the Long Garden, having some prominent and popular roses like Christian Dior, Queen Elizabeth, Iceberg, Pasadena, Montezuma, Summer Snow, First Prize, Century Two, Diri's Tysterman, etc. Seasonal Flowers of more than 70 varieties can be seen growing luxuriantly in this Garden. In winter, the Garden is repleted with a number of other annuals that have to compete with each other to find a place.

Pure flowerbeds and pyramid of colors flowerbeds are made using combination of varying heights of Dwarf annuals like *Calendula, Antirrhinum, Alyssum, Dimorphotheca, Eschscholzia* (Californian Poppy), Larkspur, Gaznia, Gerbera, Godetia,

Linaria, *Mesembryanthemum, Portulaca, Brachycome, Metrucaria, Verbena*, Viola, Pansy and Stock. Various herbaceous annuals and bi-annuals are grown in beds and informal borders. The beds are sited at the edge of lawns or along the pavements. Also, the flowers are massed irregularly with respect to their height and grouped in colour combinations to produce harmonious, natural and pleasing effects. Edging and bordering of flower beds is done with *Alyssum*, Daisy, Pansy, etc. A spectacular visual display is created by bulbous flowering plants like *Narcissus, Fressia, Gladiola*, Oriental Lily, Asiatic Lily, *Ranunculus*, Hyacinth, *Anemone, Iris*, etc. 'Tulips' and 'Cyclamen' valued for their splendid colors are important attractions of the Garden.

Source: presidentofindia.nic.in

Circular or Sunken: The next part of the Garden on its Western edge, is the Circular ('Pearl' or 'Butter Fly' or 'Sunken') Garden. It is a huge Terraced bowl lined with various fragrant and vibrant annuals. It has a bubble fountain in the middle of the bowl which enhances the grandeur of the place. The Garden derives its evergreen character from trees like Moulsri, Putranjiva, Saru, Juniper, China Orange, Roses, Tulips, Oriental and Asiatic Lilies as well as varieties of Climbers. Winter flowers like *Calendula, Antirrhinum, Alyssum, Dimorphotheca, Larkspur, Gazania, Gerbera, Lineria, Mesembryanthemum, Brachycome, Metrucaria, Verbena,* Viola, and Pansy grow well here.

Central Lawn and the Long Garden: This Garden which lies to the West of the main Garden is also called as 'Purdah' Garden, because of its shape enclosed by high walls. It has 16 square, attractive rose beds hemmed in low hedges. Along the walls are lined the resplendent China Orange whose ornamental fruits outnum-

ber the leaves. The President hosts two grand receptions in the Central Lawns every year, one to mark Republic Day on 26 January and the other on 15 August, India's Independence Day. A row of nearly 2500 Dahlias can be seen in between the seasonal flowers on both sides of the Central lawn and Long Garden. Two pergolas with stone beams which culminate in overhangs that suggest the trunks of elephants can be seen in the Long Garden where Roses are planted on two sides of a long path way.

Spiritual Garden: The Spiritual Garden contains plants which give a simple lesson to the visitors of the need for co-existence despite differences in religion and culture. It has about 40 different plants of important and different religions with a message that when plants of different nature can grow harmoniously why not the different communities. Important species among them are - Rudraksh, Chandan. Kadamba, Banyan tree, Paras, Peepal, Fig, Date Palm, etc.

Herbal Garden: In this Garden, around 33 medicinal and aromatic plants can be seen with benefits of each plant indicated next to the bed in the Garden. Jatropha; Stevia which provides safe sugar for diabetics, Isabgul *(Plantago)*, Damask Rose, Ashwagandha, Brahmi, Mints, Tulsi, Geranium, etc., are available here.

Cactus Garden: Cactus Garden was added to the President's Estate during 2003-04.It has about 80 grafted varieties. The Collection comprises specimens of *Gymnocalycium* species, known for globular form with ribs, *Cleistocactus strauaij* erect up to height of 3 meters; *Mammiliaria* species having spherical stems and feathery look; *Pygmaeocerus denudatus* is a rare small finger sized sprawling Cactus spreading from its base. *Hildwintera aureispina* commonly known as 'golden irat tail', *Coryphantha baurnamma* which is wooly and globular shaped; *Rebutia aureiflora* characterized by green and tinged bodies and Astrophylum which is short, cylindrical shaped like a star or 4 octopus. Besides these, other varieties of Cactus and succulents suitable for landscape are also planted in the Garden.

Musical fountain: The Musical fountain was established in 2005 and plays to the tune of the Shehnai and Vande Mataram. The 12 musical fountains have been designed to create identical water patterns in synchronization with light and sound.

Nakshatra Garden: It was set up in the year 2006 with a view to planting 27 different varieties of trees which are associated with Zodiac signs. According to Hindu Astrology, every person is born under any of the 27 stars (Nakshtras), i.e., 27 or 28 divisions of the sky that the moon passes through in its monthly cycle. It is believed that each constellation is associated with a tree. These trees are believed to have healthy effects on people at mental, physiological and spiritual levels if they meditate near them. These trees are also of high medicinal, social, aesthetic and economic value.

Bonsai Garden: The Bonsai Garden was set up in 2010 and contains 250 varieties of plants. The varieties of plants in the Garden include those in upright, slanting, cascade and semi cascade forms. The collection includes Bonsai of Ficus *infactoria*, Ficus panda, China Orange, *Malpighia, Casuarina, Bougainvilleas, Pinus, Mimusops elengii*, etc.

Biodiversity Park: The Biodiversity Park in the Rashtrapati Bhavan has peacocks, deer, ducks, turkeys, guinea fowls, turtles, parakeets, rabbits and migratory birds among fauna, besides a variety of floral elements.

4.3.12. Verinag Garden

Location: Jammu and Kashmir, India.
Established: Shah Jahan, Son of Mughal Emperor Jehangir, 1620 A.D.

Source: mapcarta.com

Architecture: The Verinag Garden is an adaptation traditional Persian Char Baugh. It is rectangular Garden which has water source in the centre and four radiating arms dividing the Garden in to four parts uniformly. The Verinag Garden is located on a steep hillside, with its water source at the top. The long axis of the Garden transmits water from the Southern upper end to the Northern end into the Jhelum River while the East-West running canal intersects the main water canal at its Southern end.

The entrance of the Garden is at both ends of this East-West canal. There is a walkway constructed which leads towards the octagonal pool, through a colonnade. This colonnade has twenty-four arches which surrounds the pool, whose water comes from the spring deep below. The pool's water is clear and filled with carp. The water exits from the pool is clear and filled with carp goes into the main axial water canal, which measures 305 m long by 3.65 m wide.

5. Conservation issues:

As a primary locus of geographic experience, in the course of sixteenth Century, the Mughal environmental design shifted away from Gardens towards larger urban and regional planning, in which Gardens played a diminishing role. It would be interesting to note from previous research how Mughal Gardens during the period 1500 and 1550, served as centres of social life, (Moynihan ,1988; Wescoat, 1989), how they adjusted in form, function, and meaning to new geographic situations; and how they transformed their surrounding territories (Catherine,1922; Blake, 1983; Brand and Lowry,1987; Wescoat, 1991).

It is evident from the foregoing the sites established by Mughals were developed with a view to conserve local (indigenous) natural biological resources within their natural habitats or away from their original locations within a suitable geographic location (scientifically termed *in situ and ex situ* conservation areas) that ranged in size from small vegetated plots to large imperial complexes. This was the time when they started using the term "Garden" *(Bagh)* for ex situ conservation areas some of which had symmetrical layouts, repeating decorative elements, and high enclosure walls. A few others were loosely arranged around meandering streams or natural springs, informal plantings and even open prospects. Even the Garden language connotations were referred to almost any well-ordered and beautiful subject, including persons, regions, and kingdoms as well as the varieties of Gardens that could be described as equally broad-ranging Poetic and figurative allusions. The paradise symbolism of Muslim Gardens as described earlier in this Chapter, was often accompanied, and sometimes displaced, by political, economic, and dynastic meanings. Mughal Gardens also varied widely within the places, forms, functions, and meanings associated with them and some of those variations can be explained by their changing territorial expressions, as seen in this chapter.

During the course of Mughal state formation, i.e., in the second half of the sixteenth Century, relations between Garden design and political geography changed. Even though Gardens were still important as a building type, they were physically subsumed within larger complexes as can be seen from the Agra Fort and Fatehpur Sikri and in larger programs of geographic inquiry. It can therefore be said that during this period, Garden design and political geography also changed. Gardens had a generally diminishing significance in the day-to-day construction of territory even though some elements of Garden design were refined. Besides their role as conservation areas, it is indicative from the expanding role of Gardens as funerary spaces, beginning with Humayun's Tomb, as to how the heightened symbolic significance was coupled with diminished functional significance

in day-to-day imperial activity. For example, during the reins of Akbar, during his visits to Humayun's Tomb describe its Garden as a more significant plantation area. During expanding Mughal Empires, the Gardens not only inspired Babur in orienting himself in foreign lands but also acquired specialized roles within the expanding Mughal State which was then served by geographic surveys, gazetteers and revenue records.

5.1. Conservation approach:

The Mughal period, expressed through its architecture and the relationship between the architecture and the landscape demonstrates the acquired expertise of Mughal Emperors. However, as time passed by, the original concept in establishment of Mughal Gardens for physical experience and understanding, demanded harmony and integrity of the architecture needed to be restored and the physical and visual connections between the buildings on the one hand and between the buildings and designed landscape (open spaces and Gardens) on the other, needed to be recreated. Manifestations of various layers of history, especially the British rule in Indian subcontinent (that included both, India and Pakistan) and their occupation of the country for over one and a half Century, are evident with great clarity in the architecture (designing Mughal Gardens) and the introduction of indigenous flora within these open spaces. Over a period of time these layers have not been looked into adequately with regard to their conservation efforts in such a way that both narratives and their interplay can be experienced in a cohesive manner.

Today, it can be seen that most of the constructed ('built') structures of the Mughal Gardens within three countries that have been mentioned here (Afghanistan, Pakistan and India), need scientifically aided conservation approach. Those which are regarded in today's context, as the ones who may disturb the legibility of the significant layers of history, need to be taken up for determining a separate implementation strategy.

Some of the strategic factors while adopting conservation approach for restoration of Mughal Gardens may include the following:

- The range of cultural heritage (buildings, archaeological remains, as well as open spaces) of the Gardens,
- Significance of the resource types,
- Extent of decay,
- Stakeholder concerns,
- Visitor needs and expectations,
- Available resources, for undertaking restoration efforts, etc.

The conservation cum restoration plan defined after careful assessment of the above factors can be implemented in three phases; short, medium, long term. One of the fundamental principles of conservation is to ensure that the permanent structures within the Mughal Gardens or parts of them which are in a serious state of disrepair are conserved urgently so that they are not lost. There can be certain structures that may require investigation or monitoring even before conservation interventions can be made. It would be prudent to have a conservation plan which could work laterally as well as vertically: by addressing issues which are urgent in nature, no matter under which phase they fall under.

6. Conclusion

It is said that conservation is an ongoing process and that it cannot be limited to a specific time or a Project. Therefore, all related activities of conservation cum restoration of the Mughal Gardens in the World should continue simultaneously. If some pre-implementation aspects of the Plan such as no proper studies of plant material, i.e., flora - both from books and from the actual Garden sites by way of inventory, are carried out, authentic conservation of the Gardens cannot be perceived without a thorough understanding of original planting design. Environmental planning and management may include architectural conservation as one of its components. One has to ensure that each conservation plan addresses the problems at macro level even beyond the site.

In and around several locations of the Mughal Gardens which have eventually become part of the urban environment, noise and vibration of heavy traffic and all kind of environment pollution has been affecting historic monuments. Even, illegal constructions and road expansion projects are encroaching the open spaces around these monuments of historic importance. In the light of these problems the catchments areas must be clearly defined and preserved to save these monuments from external pressures. Looking into these facts it is strongly suggested that a balanced and comprehensive approach may be followed for conservation projects. This includes,

- thorough documentation,
- complete research,
- trained and committed professional staff,
- qualified professional advisory committee and
- periodic publications on the successes and difficulties encountered during the conservation project and solutions sought to overcome such difficulties.

There is a lack of basic research on the nature of experience at Mughal Gardens, besides the practical problems as mentioned above. Moreover, there have been no detailed studies of aesthetic experience at Mughal Gardens in any era, past or present NOR there have been any studies of Garden workers (also known as *Malis*, who are generally poor and of low status), Garden visitors, or Garden superintendents. Without such knowledge the odds of speaking to modern interests and concerns at Mughal Gardens, or of influencing their conservation in any meaningful way, seem poor.

Several decades ago, Marshall Hodgson wrote, "Perhaps such [cultural] traditions can be reduced to the status of museum pieces and local color for attracting tourists; or to eclectic sources of 'inspiration' for professional designers. Tourism and eclectic inspiration are indeed evident at Mughal Gardens today, but even they seem dimly understood. Thus, in addition to the gap between gaz and gaze mentioned earlier, we must also consider the widening gulf between historical research and the experiences of those who sit, walk, and work in these Gardens. To date, there has been little probing research on what people actually experience or care about at Mughal Gardens.

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Resources Glossary:

1. **Anguri Bagh:** A garden of grapes/a vineyard
2. **Bagh:** A general term used to identify a garden; more precisely, it refers to an enclosed area within a hedge of plants, usually shrubs or trees; baghs are large and monumental in comparison to the smaller chaharbaghs
3. **Baradari:** Usually, a pavilion with 12 openings, although those with fewer openings also exist
4. **Bustan Baghs and Chaharbaghs:** Contain aromatic flowering plants; also, a vegetable garden
5. **Chabutra:** A raised platform in a garden, meant for sitting, with water flowing around or beneath it
6. **Chadar (literally, "shawl"):** A stone or marble chute; usually textured, creating bounces or ripples in the waterfall; if not textured, it contains zigzag patterns made from different-colored stones.
7. **Chaharbagh:** A garden that is smaller than a bagh and sometimes forms a section or several sections of a bagh
8. **Chaman:** A fruit garden, particularly one that specializes in grapes and pomegranates
9. **Chilla:** A place of meditation
10. **Chini Khana:** A landscape element designed within three walls with an arcade on the fourth side forming an enclosure with carved recesses or niches in the walls to hold candles or flowers in small porcelain vases; the waterfall cascades in front of the niches
11. **Dilkusha:** One of the early names associated with the garden that was later transformed into Jahangir's tomb-garden, and one of the conjunctions of the Persian word for "heart"(dil) used in the names of gardens. Bagh-i Dilkusha may be translated as "garden of contentment," "cheerfulness," or "gladness."
12. **Faiz Bakhsh (literally, "bestower of bounty"):** One of the terms Shah Jahan used for Shalamar Garden
13. **Farah Bakhsh (literally, "bestower of delight"):** One of the terms Shah Jahan used for Shalamar Garden
14. **Gaz:** A Mughal measurement for length, often translated as "yard." The equivalent length of a gaz in English units of measurement varied from 30.36 in. in the Lodi Sultanate to approximately 32 in. during Akbar's reign (1556-1605 CE).
15. **Gulistan:** A flower garden devoted exclusively to roses
16. **Hammam:** A bath
17. **Khawabgah:** A sleeping chamber

18. **Khiyaban:** An avenue of a garden
19. **Kos:** A measure of distance equal to approximately two mile
20. **Mali:** A gardener
21. **Mazar:** A shrine
22. **Minar:** A tower, usually the minaret of a mosque, but sometimes a similar form as in the kos minar towers that marked distances along a highway
23. **Sawan Bhadon:** The two months of monsoon season.

THE SECOND INTERNATIONAL FORUM
OF THE QUR'ANIC BOTANIC GARDEN
ISLAMIC PERSPECTIVES ON ECOSYSTEM MANAGEMENT

Islamic Practices and Perspectives of Other Religions in Ecosystem Conservation

CONSERVATION VALUES AND ECOLOGICAL ETHICS IN THE HOLY BIBLE

Dr Lytton John Musselman

Dr Lytton John Musselman
Mary Payne Hogan Professor of Botany, Department of Biological Sciences,
Old Dominion University, Norfolk, Virginia 23529-0266, USA
Visiting Professor, Institute for Biodiversity and Environmental Research,
Universititi Brunei Darusssalam, Brunei Sultaniate
Email: lmusselm@odu.edu

Thirteen years ago today, 22 April 2014 Earth Day, I had the privilege of launching a book in Amman, Jordan for Her Majesty Queen Rania of Jordan (Musselman, 2000). The book emphasized Jordanian plants that had spiritual significance. So today is another meaningful step in viewing environmental concerns through the lenses of faith.

The meeting organizers have assigned me the topic of environmental ethics in the Holy Bible. I am honored to do so because one of the chief questions this conference raises is this—Is there a role for faith in the practice of ecology, including an application to the problems of global warming, sea level rise and their attendant consequences on the poor and disenfranchised? Does faith provide a role for preserving biodiversity? The question might also be cast in terms of religion—is there a role for ecology in the practice of religion? These are questions we are dealing with at this conference and I commend the organizers for boldly addressing this topic. After all, we all behave based on our core beliefs.

Thankfully, there is a great deal of attention being paid to faith and environmental ethics and cannot be reviewed here. At its simplest, understanding Bible environmental ethics requires first, an overview of how creation is presented in the Bible and, second, the background of the current environmental movement. The latter is necessary to understand how the core Bible message is practiced or ignored. This is important because of seismic shifts both in the role of Christian faith in the West and the way Post-modernism views faith and the environment.

Bear in mind that I am not a cleric, not a theologian, nor a preacher, simply a botanist who loves plants and has studied the plants and the ecology of the Bible. Because I am not a student of comparative religions I can only speak from a Christ follower's perspective. The teachings of Jesus guide my view of the environment and shapes ethics and praxis. Jesus drew upon the Old Testament standards of environmental concern and expanded them. His teachings require much more than just strict adherence to rules but rather a new view of The Creation and I will emphasize His teaching.

First, then, how are environmental matters framed in the Holy Scriptures[1] ? The opening verse of the Bible says "In the beginning God created the heavens and the earth". This is the beginning of beginnings, clearly showing that in the Bible God is Creator and that reveals Himself through His creation. Characteristics of God can be known from the natural world. For example, the Apostle Paul says "since what may be known about God is plain to them [that is, people], because God has made it plain to them. For since the creation of the world God's invisible qualities—his eternal power and divine nature—have been clearly seen, being understood from what has been made, so that people are without excuse". Romans 1: 19-20. Commenting on this passage, Martin Luther reportedly referred to God as having "two books", the Holy Scriptures and the Creation, both recording attributes of the Divine.

The New Testament explains Jesus' relation to The Creation. There Jesus is called the Sustainer of all things and the Beneficiary of all creation: ". . . all were made by Christ for His own use and glory. He [Jesus] was before all else began and it is His power that holds everything together." Colossians 1: 16b-17.

Jesus has redeemed The Creation. The Holy Bible states that when Jesus returns, He will establish His Kingdom and rule with justice and mercy, this applies to the created world not just to humans. "For the creation waits with eager longing [for His return]. . ." Romans 8:19.

One of the primary teachings of the Bible is that God delights in His Creation. God gives His Own valuation of His creation: "God saw all that He had made, and it was very good". Genesis 1:31. This sets the tone for how we should view His creation, it is very good.

As a plant scientist my favorite reference to the creation is in the Gospel of Matthew 6:28-29 where Jesus says: "And why do you worry about clothes? See how the flowers of the field grow. They do not labor or spin. Yet I tell you that not even Solomon in all his splendor was dressed like one of these."

[1] All Bible quotes are from the English Standard Version.

Omitting the Creator's view of creation would naturally make creation anthropocentric. The present Deep Ecology movement is not a Christian movement per se but makes the point that the creation exists for more than just the good of humankind.

How then should Jesus' followers consider the creation?

1. The Creation must be valued and maintained. Jesus' followers are to love the world the way God loves the world. God does not create junk, if He made it, it has value. The Creation is God centered, not human centered. Put another way, creation has value apart from any benefit to humans though proper care of The Creation ultimately benefits humans through water sources, carbon sequestration; food, medicine, and shelter; as well as beauty. There are numerous biblical examples of God's environmental care such as the ban on muddying waters (Ezekiel 34:18), God's love for His creation as expressed in the care of animals illustrated by the rescue of animals by the Prophet Noah that included more than animals for draft and food (Genesis 6: 19-20).
2. The agrarian nature of society in Bible culture needs to be considered in light of the epochal changes in agricultural practice since those days. Farmers are often no longer self-sufficient but dependent upon huge multi-national companies, usually centered in the West, for seeds and fertilizers. Rather than crop rotation and periods of fallow as the Bible required (e.g., Exodus 23: 11) the goal is short-term profits. Farmers are forced into damaging the soil through intensive deep plowing, irrigation that can raise the level of salinity, and other practices that will ultimately reduce the productivity of the land that God gave to sustain His Creation.
3. God gives guidelines for accomplishing His purposes for the coming Kingdom, especially in the Gospels. Knowing at least in part what that Kingdom is like, we need to follow the well-known prescription in the Lord's prayer "Your Kingdom come, Your will be done on earth as it is in Heaven." Matthew 6:10. Jesus' followers need to practice Kingdom principles. This includes caring for creation.

Historically, there would be little disagreement regarding these basic facts among followers of Jesus. It is only with the rise of science in the West that these views of God in relation to creation were seriously challenged.

For example, scientists my age were trained to never mix religion and science, we had to strictly segregate our faith from our science. They were two different areas governed by differing ways of knowing or epistemologies. Two trends evolved—one was the union of science and technology, the other was a widening gap between science and Christianity.

While science and religion were being divorced, science and technology were being united by the middle of the nineteenth century. This conflation led to impacts on the environment with massive land and water alterations and the production of chemicals on a vast scale never seen before. The publication of Silent Spring in 1962 is generally recognized as the beginning of widespread environmental concern in the United States (Carson, 1962). This led to critical thinking about how we view the environment and how our ecology praxis was influenced by belief systems. Where were Bible environmental ethics in all this?

Five years after Silent Spring appeared, Lynn Townsend White published his famous and extremely influential paper suggesting that the ecological crisis was largely the fault of Christianity, especially western Protestantism (White, 1967). White claimed this theology taught that the natural world was for exploitation by humans. His treatise stimulated extensive discussion with a common response being to blame Christianity. He suggested that since Christianity had caused the ecological crisis it was now effete and a new religion to replace traditional Christianity was necessary.

Theologically, much of White's blame was based on misunderstanding and misapplying the verses describing The Creation in Genesis 1: 27-28. So God created man in His Own image, in the image of God He created him; male and female He created them. And God blessed them. And God said to them, "Be fruitful and multiply and fill the earth and subdue it, and have dominion over the fish of the sea and over the birds of the heavens and over every living thing that moves on the earth." The idea of dominion implies administration, White and his followers took it to mean exploitation.

But more importantly, in his analysis of the role of religion in the environmental crisis, White missed the ultimate purpose of creation--God's glory and His enjoyment.

As a result of White's essay, Christians were berated for their imperialistic attitude towards nature. One positive effect, however, was the development of a Christian environmental movement. White's work served as an alarm to theologians as well as to those of us involved in environmental matters. Slowly, theology was examined to find what the Bible actually said about creation and creation care.

Drawing upon the statements of Jesus as well as the numerous environmental rules in the Old Testament, Christians began to seriously think about environmental ethics in the Bible.

By the 1990's there was what has been described as a "greening of Christianity". Today there are many environmental associations doing admirable work in preservation of natural areas, working with endangered organisms to make the average church member aware of what the Bible teaches about creation. Large church and para-church organizations have developed statements and implemented policies dealing with climate change, sea level rise, erosion of biodiversity, and related concerns.

When the Millennial generation (born 1980-2000) arrived they inherited science divorced from religion but wed to technology and a weakened public Christianity fading from any influence in science and struggling with environmental concerns. The United States for them can no longer be properly considered a Christian nation, guided by Christian principles. Christianity has become passé. Unlike prior generations, however, Millennial thinking, based on the epistemology of Post-modernism, has ample room for questions of faith and the application of belief systems in ecology. This is a remarkable change from the enforced objectivity of the Modern Era. Millennials are active in national and international organizations dealing with global warming and related environmental issues.

What impact have these groups had on practice of faith in the United States? A 2013 study showed that rank and file church members have less environmental awareness than the general public (Clements et al., 2014).

So we arrive at the present with an uneasy truce in the United States between Post-millennial scientists and post-millennial Christians. Now scientists realize there could be a spiritual aspect of ecology. Christians believe in a Creator but struggle with how to integrate their faith and ecology. I suggest we are at a critical juncture where we have to listen to one another while remaining true to our own heart beliefs.

Struggling with this I have been greatly helped by a Muslim scholar Sayyed Hussein Nasr. In his book, Religion and the Order of Nature, Nasr considers how Islam, Judaism, Christianity, Buddhism, and Hinduism view the natural world (Nasr, 1996). He argues that there is a need to resacralize nature.

Resacralization is a reaction to secularization, an attempt to bring religious meaning to society and community life. This is different than worshipping nature, it means seeing the Divine in nature. I would argue that resacralization can only be effected by religious communities and will only be credible if it is posited from a sound scientific basis. If our metaphysical foundation includes a God or gods involved in creation than the products of that creatorial activity have intrinsic value.

How can resacralization be done? First by realizing that if we believe in a Creator God or god anything from the hand of that God has intrinsic value, value in its own right as a divine creation just as we are part of the creation. This means, for

example, that a tree has intrinsic value—it is valuable not because it provides timber, fruit, shade, or a cure for Ebola. It is valued because it is from The Creator. Until the past ten or fifteen years, my overseas experience in ecology programs run by western development agencies was that they were too frequently blatantly imperialistic with the foreign "expert" trying to justify the preservation of an endangered species based on its rarity or on its potential human value. While the local population invariably believed the tree was created by a god or gods, such a viewpoint was considered "primitive" and backward. Fortunately, that has changed and now development projects often contain a faith component or at least an acknowledgement of the faith of the local people. A measure of progress that has been made is evident from the titles of some papers at this conference.

The environmental movement must take into account people of faith and try to understand how they think about endangered species, biodiversity, and ecosystem services. I think there has been honest progress on that front. More work needs to be done by faith communities in understanding the science and technology of environmental concerns.

A Summary of Environmental Ethics in the Bible

1. God is the Creator, therefore all creation has value completely independent of its use by humans. God takes personal delight in His creation, "and God saw that it was good." and He loves His creation "For God so loved the world".
2. God is the sustainer. He has chosen to entrust His creation to humans. Because of the entrance of sin humans are marred custodians of creation.
3. God is the Redeemer or Restorer of creation marred by sin. The Bible teaches that in a coming day God's Kingdom will be established on earth as it is in heaven and all creation will not only be restored but made anew. Jesus encourages us to begin that process right now.

I would like to close by a famous poem that very well summarizes the relationship of the Creation with its Creator as enshrined in a tree. It is by the American poet Joyce Kilmer (1886-1918). I think that I shall never see a poem lovely as a tree.

A tree whose hungry mouth is prest
Against the earth's sweet flowing breast;

A tree that looks at God all day,
And lifts her leafy arms to pray;

A tree that may in Summer wear
A nest of robins in her hair;

Upon whose bosom snow has lain;
Who intimately lives with rain.

Poems are made by fools like me,
But only God can make a tree.

Acknowledgements

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Islamic Practices and Perspectives of Other Religions in Ecosystem Conservation

REFLECTIONS ON CULTURAL AND SPIRITUAL VALUES, TRADITIONS AND CUSTOMS IN CONSERVATION

Dr Gonzalo Oviedo

Dr Gonzalo Oviedo
International Union for Conservation of Nature (IUCN)
Email: gonzalo.oviedo@iucn.org

Overview

The nature conservation paradigm that became predominant in international environmental policy in the XX century had its origins in "Western" societies, where it emerged as a counter narrative to industrialization and the massive transformation of the natural environment for economic development that capitalism brought in. Nurtured by the ethics of the land, the philosophical romanticism that preconized the value of emotion and the aesthetic experience of nature, and the progress of natural sciences, the conservation paradigm acquired strength and importance in those societies and achieved substantial objectives, and later was also successfully adopted in developing nations. In international environmental policy, reflections of this process were among others the several environmental instruments developed in particular in the period between the 70s and the Rio Conference in 1992, which produced the Rio Conventions, Agenda 21 and other key outputs. Although more complex and richer than the original paradigm that focused mostly on the protection of wilderness areas, the conservation approaches developed through those processes were still largely modelled by that original paradigm.

Although today the conservation community continues to alert about the ongoing effects of the development models on the loss of biodiversity, the degradation of ecosystems and the acceleration of climate change, it is clear that without the successes brought about by the processes that emerged from that conservation paradigm for over a century the situation of the planet would be much worse.

However, the conservation policy and practice originated in that Western paradigm had several negative effects that today are widely recognized and to some extent addressed by conservation actors. One of them is what has been termed the "nature-culture divide", that is, the notion that humans and their cultures are intrinsically disconnected from nature or even opposed, and that generally humans are the root of environmental degradation. Two consequences of this belief (which is in fact more complex but is presented here in a simplified way) was a predominant practice of excluding humans from conservation areas and removing human uses and living cultural features from conservation management.

Another consequence of this perspective of conservation was the formulation of a discourse that put "conservation science" at the helm of decision-making, policy and action, on the understanding that natural sciences should determine the measures needed to protect and restore biodiversity and ecosystems. The problem in this thinking was not the value of science as such, but the assumption that conservation decisions should follow rationalist and positivist argumentations and not societal and cultural processes. A key belief under this perspective was that "conservation science", being universal because is based on natural sciences, should be above the relativism of cultures and societies. A practical effect of this way of thinking was, for example, the universalization of a model of protected areas defined as science-based and with standardized methodologies and approaches.

The research, thinking and practice of conservation especially since the 90s have significantly evolved, and although the conceptual and methodological approaches of the conventional conservation model are still deeply embedded in many conservation institutions, the trends that we witness today in policy and practice reflect profound changes and configure entirely new ways of implementing conservation.

An important moment in this process of change in the conservation paradigm was the V World Protected Areas Congress of 2003. It built on developments of the Convention on Biological Diversity (CBD) which for a decade, since its adoption in 1992, had been generating new policy frameworks on key issues such as traditional knowledge, sustainable use and the ecosystem approach (Korn et a., 2003); and on contributions from social science and a large practice of community-based natural resource management. A useful summary of the changes in

course in the protected areas paradigm, which is worth citing here in extensor, was presented by Phillips and others soon after the 2003 Congress (Borrini-Feyerabend et al., 2004: 3):

A paradigm shift in protected areas management

The conventional understanding of Protected Areas	The emerging understanding of Protected Areas
Established as separate units	Planned as part of national, regional and international systems
Managed as "islands"	Managed as elements of networks (protected areas connected by "corridors", "stepping stones" and biodiversity-friendly land uses)
Managed reactively, within a short timescale, with little regard to lessons from experience	Managed adaptively, on a long time perspective, taking advantage of ongoing learning
About protection of existing natural and landscape assets - not about the restoration of lost values	About protection but also restoration and rehabilitation, so that lost or eroded values can be recovered
Set up and run for conservation (not for productive use) and scenic protection (not ecosystem functioning)	Set up and run for conservation but also for scientific, socio-economic (including the maintenance of ecosystem services) and cultural objectives
Established in a technocratic way	Established as a political act, requiring sensitivity, consultations and astute judgment
Managed by natural scientists and natural resource experts	Managed by multi-skilled individuals, including some with social skills
Established and managed as a means to control the activities of local people, without regard to their needs and without their involvement	Established and run with, for, and in some cases by local people; sensitive to the concerns of local communities (who are empowered as participants in decision making)
Run by central government	Run by many partners, including different tiers of government, local communities, indigenous groups, the private sector, NGOs and others

Paid for by taxpayers	Paid for from many sources and, as much as possible, self-sustaining
Benefits of conservation assumed as self-evident	Benefits of conservation evaluated and quantified
Benefiting primarily visitors and tourists	Benefiting primarily the local communities who assume the opportunity costs of conservation
Viewed as an asset for which national considerations prevail over local ones	Viewed as a community heritage as well as a national asset

Regarding scientific approaches, the table above precisely contrasts the "conservation science" approach with an understanding that is inclusive of socio-economic and cultural objectives. Indeed scientific disciplines of ethnobiology, ecological anthropology and others where the "natural" and "socio-cultural" realms met made in the last decades important contributions to understanding the ways in which human cultures, especially "ecosystem people" cultures in Dasmann's terminology (1991), or Nabhan's "cultures of habitat" (1998), have adapted to their environments by often practising ecosystem management that contributes to the maintenance of ecosystem elements and functionality.

Research has also pointed out that rich knowledge systems are frequently associated to the practices of traditional cultures for managing their environments, and that conventional science and epistemological paradigms especially from Western societies need also to change their perspectives and enter into dialogue with traditional knowledge systems for mutual enrichment and for better sustaining conservation practice.

An important conclusion of these reflections and processes is that conservation paradigms, no matter how much they are based on formal sciences, are always cultural: they are generated in cultural contexts and by cultural processes where value systems are determinant. The ethical frameworks that drive conservation agendas are cultural too, and although humanity as a whole can agree on higher values about nature and the planet, such ethical and policy agreements cannot erase the specificities of diverse cultural value systems and the societal processes of each people and nation.

In this context, therefore, a fundamental process of re-valuing conservation traditions of different peoples has emerged as a key factor in advancing towards sustainability and resilience. Today there is growing recognition, for example, that there is no one single universal protected areas model that has legitimacy and has to be implemented forcefully in every place: there is in fact a multiplicity of

protected areas models that different cultures have created in history, starting in many cases much before the XIX century.

Humanity is highly culturally diverse; by standards of language, at least 7,000 distinct ethnolinguistic groups exist today (Oviedo et al., 2000) – a diversity that was even greater in the past. Accordingly, systems of values, traditions and beliefs are also very diverse, notwithstanding the fact that major belief systems and religions are shared by many cultural groups. Within this large cultural diversity, many examples can be found of how value and belief systems, especially of "cultures of habitat", underpin nature conservation and form part of the resilience of societies to changing and often challenging environments. If the notion that "… while proof of conservation success is ultimately biological, conservation itself is a social and political process, not a biological process" (Alcorn, 1994: 11), and that accordingly conservation models are determined by social contexts and value systems, then it follows the need to recognize that a multiplicity of conservation models exist de facto, and that the conservation agenda has to be inclusive of such diversity and avoid standardization of models of thinking and action.

A remarkable example of the diversity of protected area models (or conservation models more broadly) is the "*hima*" system of the Arab world, which has different elements and denominations in various countries but is a widely spread cultural practice. *Hima* is essentially a protected place within a wider landscape, where natural resources are carefully managed especially for times of scarcity so as to avoid their depletion and to ensure sustained production of goods and services for the communities. As in any formal protected area, *hima* areas are managed through regulations of use and institutions in charge of enforcement; in terms of conservation and sustainable use objectives, as well as in terms of governance, *himas* are protected areas in full sense (Kilani et al., 2007). The problem today is that they are not necessarily or sufficiently recognized by national legal frameworks and institutions.

The same is true for many other conservation practices of human cultures. In the Amazon region of South America, indigenous peoples' territories are growingly recognized by scientific research as areas having the same functions as protected areas, and even being more effective in achieving conservation (Nepstad et al., 2006). Many indigenous groups in that region demand today that their territories are legally and formally recognized as "Indigenous Conservation Territories" – a term that they have coined as their cultural equivalent of formal protected areas (IUCN, 2008a).

Similarly, a strong case has been made in the last few years for recognition of the broadly termed "Indigenous Peoples' and Local Community Conserved Ter-

ritories and Areas" (ICCAs), a concept that has made its way into the CBD Programme of Work on Protected Areas and that is today in the agenda of many conservation agencies (ICCA Consortium, 2014). ICCAs as a concept comprise a wide variety of places that indigenous peoples and local communities manage with conservation and sustainable use outcomes, and that are governed through their own rules and institutions.

Another important example of how traditional peoples have set up their own conservation initiatives and practices is the case of "sacred natural sites", defined by IUCN as *"areas of land or water having special spiritual significance to peoples and communities"* (Wild and McLeod, 2008). These are natural sites where communities place or identify particular spiritual values associated to their belief systems, and where such communities implement measures to guarantee the integrity of the natural features.

Recent research and practice has demonstrated the role of fire management by traditional cultures in shaping landscapes and conserving biodiversity (see for example Rodriguez, 2007). It has been demonstrated that traditional "forest cultivation" techniques by forest peoples like the Karen in Thailand create more diverse habitats that increase biodiversity (Delang and Wong, 2006). Taboo in many traditional cultures has played a key role in conserving and managing species in terrestrial and marine environments (e.g. Lingard, 2003) by creating systems of rules and regulations that are strictly followed by the population. Many other similar forms of traditional systems and practices have been documented as contributors to biodiversity conservation.

Clearly there is immense value in recognizing and integrating in the conservation agenda this wide array of conservation models and practices that communities worldwide have created themselves – in particular because the more they are recognized and supported, the greater the engagement and commitment of those communities will be for continued stewardship of their lands and resources. But there is an additional dimension in the emergence of these trends to recuperate such models: a revival of nature-related values and practices from the bottom. It is not only through research and conceptual and policy developments that the conservation paradigms have been changing; it is also largely due to processes initiated by the communities themselves, or where they have become active and determining players and owners. This is exemplified by many cases of communities and organizations representing them that have presented their cases to governments and international agencies in request for recognition and support; in the Amazon region, a quick survey of indigenous-led protected area initiatives by IUCN's South American Office identified at least a dozen cases involving large

territories (Troya, 2013: comm. pers). It is also exemplified by many policy initiatives put forward by communities and organizations for consideration of their own approaches and frameworks by conservation agencies and governments – such as under the philosophy of defense of Mother Earth (*Pacha Mama*) in the Andean indigenous world.

Towards an agenda of culture-inclusive conservation

Broadly speaking, culture is the carrier of determining elements of human behaviour towards natural and social environments, and is also a result of adaptations of such behaviour over time. It includes value systems, traditions and beliefs, as recognized by the Universal Declaration on Cultural Diversity, which defines culture as "the set of distinctive spiritual, material, intellectual and emotional features of society or a social group, and that it encompasses, in addition to art and literature, lifestyles, ways of living together, value systems, traditions and beliefs" (UNESCO, 2001). For the purpose of our reflections, key elements of this definition are "value systems, traditions and beliefs" as they connect to the natural environments; they constitute the determining elements of how humans interact with nature and at the same time they are to a great extent shaped by such interactions.

The first element of an agenda for conservation that is inclusive of culture is therefore the acknowledgment that in any particular context the "value systems, traditions and beliefs" of the people who interact with the place need to be understood, respected and integrated; as called for by IUCN, it means "understanding and incorporating diverse cultural values and practices into the planning, design and implementation of programmes to conserve the integrity and diversity of nature" (IUCN, 2008b).

This aspect is more complex than it first appears, because "understanding and incorporating" the contributions of cultural approaches and practices to biodiversity conservation should avoid the risk of instrumentalization of such cultural elements to "support" the conventional paradigms. This is in fact a problem frequently seen in the conservation literature. What is needed instead is to recognize (and seek to harmonize) the different values.

For example, for some conservation biologists certain elements of the conventional paradigms are rigid and unquestionable – such as species diversity (in terms of numbers of species), endemism, or uniqueness of ecosystems. But for some cultures a narrow definition of "biodiversity" is problematic, because although cultures do value diversity of species and ecosystems, they value more

their functionality for their territorial landscapes, the livelihoods and the cultural processes; although they value biological features, they equally value non-biological features as part of the landscape (mountains, volcanoes, rocks, sand, water sources, and of course the sun); therefore, "nature", "earth" or "cosmos" are concepts that speak more to those cultures than "biological diversity" (Oviedo, 2007).

On the other hand, there has to be a fundamental reconfiguration of "priorities" associated to "values" in the conventional conservation models. The common approaches of placing higher priority in conserving "hotspots" of biodiversity defined by indicators of numbers of species, endemism and uniqueness have to change to understanding and recognizing that for traditional peoples who live from the land all biodiversity is important, no matter whether it is high or low. Such cultures evidently prefer to have natural areas rich in life and other features, but in conditions of low biodiversity they equally value what they have – sometimes they may value it more. Therefore while still placing high value in conserving biodiversity "hotspots" for their importance for the planet, the conservation agenda should not underestimate the need to understand and integrate the other types of values that cultures place on their natural places or features. A clear case in point is the fact that up to now the conservation of drylands receives much less attention than the conservation of forests, yet many traditional cultures depend entirely on the wise management of the dryland resources, starting with soil and water, and also the ecological functions and values of the drylands (such as carbon storage) remain little recognized.

Reconfiguring the way we interact with other cultural systems is the basis for bridging the "culture-nature divide" that has been very often identified as an obstacle for effective conservation (McNeely, 2003) as it has overlooked the fact that natural landscapes are largely also cultural landscapes, that is, landscapes modified and influenced by cultures, and consequently has alienated local people from engaging in conservation on the basis of their own values and traditions. It has been proposed that to overcome the culture-nature divide there has to be an evolution towards a "biocultural" understanding of nature and conservation, as well as of the links between biological and cultural diversity: Biodiversity also incorporates human cultural diversity, which can be affected by the same drivers as biodiversity, and which has impacts on the diversity of genes, other species, and ecosystems" (UNEP, 2007: 160).

Indeed since the early 1990s, a new field of research has emerged premised on the concept that the diversity of life on Earth is biological and cultural, and that "biocultural diversity" should be now at the core of conservation agendas (Maffi and Woodley, 2008). This area of research and policy has been supported by studies about the distribution of "cultural systems" (mainly by standards of language diversity) and the distribution of diverse types of ecosystems, which show strong correlations that suggest patterns of co-evolution and systemic links. Supporting the maintenance of cultural diversity should be therefore considered an important approach to the conservation of biodiversity in different landscapes and contexts. As stated in the UNESCO Declaration on Cultural Diversity,

"Culture takes diverse forms across time and space. This diversity is embodied in the uniqueness and plurality of the identities of the groups and societies making up humankind. As a source of exchange, innovation and creativity, cultural diversity is as necessary for humankind as biodiversity is for nature. In this sense, it is the common heritage of humanity and should be recognized and affirmed for the benefit of present and future generations" (Art. 1).

Operationalization of the concept of "conserving biocultural diversity" can be mobilized by focusing on particular situations where there is more evidence that natural and cultural features have "co-evolved" during certain periods of time sufficient to have noticeably influenced each other. A good example of this is the "protected landscape" category:

"Area of land, with coast and sea as appropriate, where the interaction of people and nature over time has produced an area of distinct character with significant aesthetic, ecological and/or cultural value, and often with high biological diversity. Safeguarding the integrity of this traditional interaction is vital to the protection, maintenance and evolution of such an area" (Dudley, 2008: 20).

This definition can be applicable for example to any traditional territory of indigenous peoples and rural communities. Another good example is the definition of cultural landscapes of the World Heritage Convention, which is essentially the same although it appears more convoluted:

"Cultural landscapes are cultural properties and represent the "combined works of nature and of man" designated in Article 1 of the Convention. They are illustrative of the evolution of human society and settlement over time, under the influence of the physical constraints and/or opportunities presented by their natural environment and of successive social, economic and cultural forces, both external and internal" (UNESCO, 2011: Art 47).

The notion of "over time" in the above definitions regarding interaction of nature and culture requires further elaboration for its operationalization. The key question is what range of time a society may need to generate a "biocultural product" such as a protected or cultural landscape that has identifiable biocultural traits. There is room for discussion on this including because it can vary from place to

place, but generally it means "over generations". Probably a landscape requires at least three generations of substantive interaction between nature and culture to become a distinct "biocultural product". From an understanding of what this process means it could be possible to identify criteria and indicators of biocultural diversity that can serve to plan and implement biocultural conservation.

An expert workshop convened by UNESCO and The Christensen Fund (UNESCO, 2008: 23) recommended that a conceptual framework on biocultural diversity should:

1. Be holistic and interdisciplinary and clearly recognize that humans form an integral part of the biosphere with their actions deeply and often irreversibly affecting its features.
2. Be inclusive in its scope and include indigenous people and other local communities whose lifestyles have been affected and transformed by different faces of modernization and thus currently live under non-traditional conditions, namely in rural, urban and periurban areas.
3. Go beyond the identification of analogies and correlations between biological and cultural diversity, including linguistic diversity, and focus on the various ways in which these components of diversity are articulated.
4. Draw and expand upon existing conceptual frameworks including biocultural diversity, cultural ecology, systems approach, ethnoecology, resilience and historical ecology.
5. Provide a logical and coherent way of including and linking issues of global trends, scale, resilience, credibility and trade-offs between different forms of diversity.
6. Develop a package of methodologies and strategies for its implementation and communication to different publics, namely communities, scientists and policy makers."

A fundamental element of culture-inclusive nature conservation is traditional environmental or ecological knowledge – or traditional knowledge for short. This has been well recognized already in international and national environmental policy – for example all the "Rio Conventions", the World Heritage Convention, the Ramsar Convention, the Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES), and the UN Forum on Forests (UNFF) have developed policy provisions and in some cases operational frameworks for the recognition and integration of traditional knowledge, and many institutions doing in situ and ex situ conservation have developed and implement relevant areas of work. The many developments in this field make it unnecessary to elaborate further on its importance, but it is pertinent to highlight some issues that could be part of

advancing an agenda for culture and conservation:

- Further research is needed on substantive topics of traditional knowledge for conservation and sustainable use of ecosystems. Ethnoscientists have been working with knowledge holders in many parts of the world and there is evidence of the importance of traditional knowledge for example on plant taxononomies; succession of ecosystems, for example in the case of fire management and "forest cultivation" systems; interactions between animal and plant communities, for example in the case of grazing across landscapes and different ecosystems; climate-related knowledge, for example for meteorological predictions and species adaptation; population dynamics of certain species of economic and cultural importance – for hunting, fishing, cultural practices, etc.; pest management; water related knowledge and harvesting and management techniques.
- Similarly, more analysis is needed about key areas of application of traditional knowledge to better understand its relevance and functionality – for example about climate change adaptation processes; biodiversity and human health: one of the areas where traditional knowledge remains relevant and in some contexts of primary importance is traditional medicine – medicinal plants and animals, maintenance of dietary diversity and nutrition based on biodiversity, etc.; production systems for adaptation to a variety of conditions – for example integrating traditional knowledge in agroforestry systems; development of approaches to fisheries management through the articulation of traditional knowledge and modern techniques; small scale agriculture; transition from traditional hunting to community-based wildlife management; etc.; traditional knowledge for tracking applied to landscape assessments and management; community mapping as tool for eliciting the application of traditional knowledge to protected area management.
- Better understanding of processes for development, transmission and preservation of traditional knowledge is required, taking into account the dynamic nature of knowledge generation and transmission. This includes for example: processes of intergenerational transmission – how traditional knowledge is passed to new generations and how functional the transmission systems are in the presence of "disruptors" such as schooling, the media and cultural change; processes of knowledge generation and elaboration that can help maintain links between ecosystem-related practices and knowledge holders and repositories and facilitate dissemination and access – including links between knowledge holders and scientists, multiple-knowledge libraries, support to knowledge systematization, new types of institutes and centres, etc.
- Clarification of the relationship between the various levels and types of traditional knowledge and science – awareness, familiarity, general knowledge, science, to avoid the misconception that "all traditional knowledge is science and the only difference between both is that they are different knowledge

systems". As in every society and culture, not all the knowledge that comes from tradition is scientific – some is, some is not.

- The problems of "validation" or "verification" of traditional knowledge should be openly addressed. While at the local level traditional knowledge may not require validation procedures because it is already verified by cultural practices and is culturally relevant, broader applications outside of those cultural contexts may require some form of validation, as in formal science.

Understanding, respecting and supporting "sacred natural sites", or natural places with particular spiritual values for communities, and plant and animal species that also have particular spiritual values, is a key component of today's approaches to culture-inclusive conservation. There is a profusion of literature that documents the conservation importance and value of such places and species not only for the local cultures but for global conservation objectives. While interest on this topic in the conservation community started from the realization that many places and species with spiritual values had been integrated in formal protected areas and required especial attention, it has expanded to take a much wider approach to landscape management and to bioregional features. It connects also to the growing recognition of the spiritual and religious values for sustainability and planetary ethics, and to the increasingly important presence of faith-based groups in the environmental scene from local to global levels. These various elements configure today an agenda on conservation and spirituality that has a place of its own in the environmental processes worldwide.

A number of challenges remain however for the development and expansion of this agenda. Insufficient knowledge about the extent of natural areas, species and landscapes carrying spiritual values, more anecdotal than systematic information, processes of rapid erosion of cultural and spiritual values especially in areas under dynamic change, and lack of solid policy frameworks for supporting communities in their effort to protect places based on their spiritual values are some of the challenges.

As indicated earlier, together with places, species and landscapes of spiritual significance a new conservation agenda needs to more active include other culture-based conservation outcomes and practices of communities, such as the hima and agdal practices in the Arab world, or the configuration of indigenous peoples' territories as protected places, or the great diversity of ICCAs in terrestrial and coastal/marine areas. Several forms of culture-based conservation practices associated to traditional knowledge have been listed above, and the literature is not short of relevant examples of a wide variety of such practices (see for example Zogib, 2013).

A fundamental area of development of a culture-inclusive conservation agenda is scientific research. Some potential topics have been already mentioned, and many others can be identified, in the fields of scientific knowledge and conservation policy, such as:

- The role of culture in setting targets and indicators for nature conservation. How universally defined targets and indicators (such as on reducing the risks of species extinction and increasing the percentage of areas under protection) can be combined with culturally defined targets and indicators – such as the sustainability of areas under customary management?
- How to support communities in defining the balance between cultural change and cultural maintenance in the management of ecosystems? How much focus should be placed on factors and processes of cultural change versus the options of cultural maintenance?
- How much effort should be placed on the challenges that "minority cultures" face versus mainstream cultures? Evidently the mainstream cultures of certain societies are having much greater impact on the natural conditions than the minority cultures – yet these may conserve richer elements of cultural cosmologies, ethics, knowledge and stewardship of nature.
- How to reconcile multiple spiritual traditions coexisting in given landscapes?

A final element of a conservation agenda based on the recognition of culture that should be considered is the need for further development of cultural aspects in international and national environmental policy. It has been already indicated that many international instruments recognize various elements of culture as important for nature conservation, in particular traditional knowledge; but other aspects of culture lack still systematic consideration, including the need to understand and respect the spiritual values of nature for many societies. At the same time, there is a growing opportunity to link instruments and processes on culture to environmental and nature conservation processes; good examples are the current work in the World Heritage Convention context for more integration of nature and culture, such as the "Connecting Practice" project undertaken by IUCN and ICOMOS advisory Bodies to the WHC (IUCN, 2014), and the development of the cultural landscapes category in the WHC. The UNESCO Conventions and Declarations on culture also increasingly recognize the links to nature conservation actions or frameworks. UNESCO-CBD Programme of Work on Biocultural Diversity (UNESCO: 2008) offers also a good entry point for connecting nature and culture in international policy.

Concluding thoughts

As described in the Overview, fundamental changes have taken place in the form nature conservation is conceptualized and practised in the world, and although the degree in which such changes are applied and mainstreamed varies from country to country and from place to place, it is safe to say that the conventional conservation paradigms of the XX century are today in retreat. One of the important components of the change of paradigm is the recognition and integration of cultural and spiritual values and traditions in the conservation thinking and practice. This is a welcome development because there can be many legal obligations and mandates for shifting to sustainability, but people only change behaviour in a lasting way when they have values and convictions providing the rationale for change and when and they are confident that changes will bring benefits for new generations.

Integration of cultural and spiritual values and traditions in conservation should be multifaceted and should connect to wider aspects of new paradigms, in particular those relating to the role and duties of communities in conserving nature and building planetary resilience. Starting with a new understanding about culture and conservation, as described in this paper, it should link to ethical frameworks of sustainability and stewardship, as expressed in cultural cosmologies and value systems (such as the *Pacha Mama* philosophy of nature) and in spirituality and faith-based ethics.

A cultural perspective of conservation should include a cultural rights approach, to strengthen the position of communities and individuals in conservation dialogue and in the search for societal choices. As stated in Article 5 of the UNESCO Declaration on Cultural Diversity (2002), "Cultural rights are an integral part of human rights, which are universal, indivisible and interdependent. The flourishing of creative diversity requires the full implementation of cultural rights as defined in Article 27 of the Universal Declaration of Human Rights and in Articles 13 and 15 of the International Covenant on Economic, Social and cultural Rights". Recognizing and respecting the culture-based approaches and practices of conservation by diverse communities and peoples is therefore not a concession of conservation actors that want to be inclusive – is the recognition of a fundamental right of the people and therefore respecting it is a duty of the conservation community.

The conceptual and ethical frameworks of culture-inclusive conservation should be followed by several building blocks of conservation methodology and practice. Some of the elements suggested in this paper for a practical agenda are:

- Greater focus on "biocultural" areas such as cultural landscapes and other places noticeable shaped by cultures and having strong cultural significance together with biodiversity values;
- Greater attention to community-based conservation of areas, species and features of the landscape, including recognition and respect for community value systems and traditional philosophies of nature;
- Active efforts for the revitalization and application of traditional knowledge related to nature conservation, understanding that vitality is associated with the capacity knowledge holders to master change and to interact with science and other knowledge systems;
- Recognition of and support to the many forms of nature conservation and management based on spiritual values and traditions of communities worldwide, including natural areas and landscapes with sacred, spiritual or holy values, as well as species with special spiritual significance;
- Promotion of new ways of thinking, policy and practice in international and national environmental and cultural policy making, following the several constructive initiatives that are underway in different fora and processes;
- Develop multi-layered approaches that combine or include "minimalist" and "maximalist" approaches, i.e. from cultural safeguards (do no harm local cultures when practising conservation) to active biocultural conservation.
- Stimulate research efforts by the academic community to increase understanding of the ways in which culture interacts with nature and to support more solid approaches to conservation policy and practice.

In the context of a rapidly changing world, the growing recognition of the importance of community stewardship and sustainability practices to counter the drivers of consumerism and homogenization requires a new understanding and re-valuing of cultural systems that sustain and enable community actions. The formulation and application of culture-inclusive conservation approaches should thus become a key element of more effective conservation agendas.

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THE SECOND INTERNATIONAL FORUM
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Exploring Opportunities and Challenges
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MANGROVE ECOSYSTEMS AND DISTRIBUTION IN THE ARABIC REGION: INSTRUMENT FOR FACING EROSION AND CLIMATE CHANGE ALONG ARABIC COASTAL AREAS

Dr Hany El Shaer

Dr Hany El Shaer
Programme Manager; Protected Areas, Biodiversity & World Heritage Programme
Regional Office for West Asia (ROWA) - International Union for Conservation of Nature (IUCN)
Amman - Jordan
Email: hany.elshaer@iucn.org

Introduction

Mangrove forest belongs to the world's most productive ecosystems. It plays a vital role in coastal biodiversity; this ecosystem supports a rich diversity of flora and fauna. It is composed by salt-tolerant trees that grow in the shallow tidal waters of some coastal areas of the Arabic seas. They require slow water currents and plenty of fine, organic sediment in which to set their roots, as well as protection from high energy waves. The muddy waters, rich in nutrients from decaying leaves and wood, are home to sponges, worms, crustaceans, molluscs and algae, and provide shelter for marine mammals and birds. Mangroves are essential fish nurseries and contribute to the vitality of commercial fisheries. The naturally-occurring species of mangrove *(Avicennia marina (Forsk.) Vierh.* found in Red Sea and the Gulf sea, locally called '*Qurm*', of the gulf area is the grey or white mangrove, due to the colour of the underside of its leaves. Technically, the term mangrove refers to a plant while the *mangal* is the plant community and habitat where mangroves thrive. The plants in the *mangal* can be diverse but all have special adaptations to overcome the problems of anoxia, a lack of oxygen in the continually water-logged soil; high salinity levels; and frequent inundation by the tides.

Some areas of mangrove are under varying degrees of stress, especially close to coastal developments, due to dredging, sedimentation and altered flow regimes. They are the only forests situated at the confluence of land and sea in tropical and subtropical latitudes. Scattered information is available about the biodiversity of mangrove ecosystems from the West Asia region. This article aims to review the available information and to assess the current status of biodiversity in mangrove ecosystems of the Arabic region.

Mangrove ecosystem

The habitats shaped by mangroves are variously termed forests, swamps and communities. The intertidal zone in which mangroves grow is restricted spatially, bound as it is by the sea on one side and terrestrial environments (where competition for space with other plants is fierce) on the other. Aridity and high salinity often further restrict growing space. Although adapted to salinity, mangroves thrive in areas where seawater is diluted by high regular rainfall, groundwater flows or rivers. Where conditions are conducive - typically in deltas, estuaries and coastal lagoons in wetter regions - mangroves form extensive forests, where canopy height may reach 30 m or more. At the other extreme, where conditions are arid or saline, fewer species can survive and trees grow only in dwarf or scrub formations. Mangroves are widely found along open coastlines in places where wave energy is sufficiently low and suitable sediments occur.

Mangrove distribution

According to the World Atlas of Mangroves, the most accurate estimate ever compiled (Giri et al., 2010), the global mangrove area is 152 360 km2. Mangroves are found in 123 countries and territories. Despite this broad range, over two-thirds of the world's mangroves are found in just twelve countries, with Indonesia alone accounting for over 20%.

Mangrove distribution along the Red Sea

1. Egypt

Mangrove stands in Egypt are, in general, relatively small .They are dispersed along the Egyptian Red Sea coastline in sheltered bays and lagoons protected behind coral reefs. The mangrove stands along the Gulf of Aqaba and the Egyptian Red Sea coastlines cover a total area exceeding 550 hectares. They are predominantly mono-specific, consisting only of *Avicennia marina (Forsk.)* Vierh., except for a few stands in the southern Sudanese border area where *Rhizophora mucronata Lam.* coexists along with *Avicennia* marina. From a geographical point of view, the Egyptian mangroves may be divided into the Sinai mangroves, and mangroves growing on the Egyptian-African Red Sea coast, Galal (2003). The Sinai mangrove thickets are found only on the south-eastern tip of the Sinai Peninsula. They consist of five stands. One of these includes a small group of Avicennia trees growing along a channel that cuts across Ras Mohammed at the southern extension of the peninsula. The other four stands are denser and are found along a 20km stretch of coast on the alluvial fan of Wadi Kid, to the north of Nabq Oasis. They are, from north to south, Shura Al Manquata, Shura Al- Rowaisseya, Mersa Abu Zabad and Shura Al-Gharqana (Shura is local name for an Avicennia stand). All mangrove stands in Sinai are monospecific - Avicennia marina. Except for the sparse mangrove of Ras Mohammed the stands are characterized by tree growths developing in the shelter of a broad subfossil-reef flat. At low tide the reef flat is only covered by a few centimetres of water or is dry. The holes in the landward side of the reef flat become true lagoons around which the mangrove stands develop.

Galal (2003) reported mangroves at 23 localities between latitudes 27° 40'N and 22° 33'N, most of which are only small patches or aggregations of stunted *Avi-*

cennia marina in : Geisum Island , Al-Gonah , Abu Minkar Island ,Safaga Island ,South Safaga ,Wadi Abu Hamra , Sharm El-Bahari ,Sharm El-Qebli ,Wadi El-Gimal , W. El-Gimal Island , Ras Baghdadi, Hamata mangroves, Wadi Mastura,Wadi Al-Qulaan ,Wadi Rawada Al-Edaiah ,Wadi Harbiyyah , Shawareet Island ,Wadi Lahmy, Quoraat Hartawy , Mersa El-Hamira mangrove , Shalateen Island ,Sharm- El-Madfaa ,Mersa Shaab ,Mersa Abu Fassi ,Wadi Al-Hoor and Adaldeep

2. Sudan

Mangrove stands were reported at 17 localities along the Sudanese Red Sea coast. These include, from north to south, Mohammed Qol, Arakiyai, Halut, Kilo Tammania, Klanieb, Mersa Atta, Adofab, Lagagengeeb, Fagum, Haydob, Sheikh Ibrahim, Tekranyai, Sheikh Saad , Ashat, Halaib, Mukawwar Island (Magarsam) and Agig. Avicennia marina was the only mangrove species reported in the country. Older reports have recorded that other species were present in the past. Andrews (1950) reported both Rhizophora mucronata and Bruguiera gymnorrhiza (L.) Lamk as occurring south of Suakin. Kassas & Zahran (1967) reported R. mucronata in mangrove stands north of Halaib, near the Egyptian border.

3. Saudi Arabia

Both Avicennia marina and Rhizophora mucronata are found, although the occurrence of the latter is restricted to a few localities. The northerly limit for distribution of the Avicennia marina is Sharm Zubeir (Lat. 27° 25'N). It extends south beyond Jizan and into Yemen. Based on the distribution and density of the Avicennia mangroves along the shore (PRICE et al. 1987; Mandura et al. 1987, 1988; Mandura & Khafaji 1993). Mangrove stands were reported at different localities along the Saudi Red Sea coast in: Sharm Zubeir, Al-Wajh to Umm Lajh, North of Jeddah to Yanbu, Jeddah South Corniche North of Al-Lith, Between Al-Lith and Khor 'Amiq, Khor 'Amiq to Al-Qahmah, Shuqaiq Mangrove , Khor Wahlan and Farasan Islands (Alwetaid ,2003) .

4. Yemen

Typically, the mangroves grow as thin forests along the shoreline, on near- and offshore islands, and fringing tidal inlets and channels locally known as khors. These extend landwards along depressed areas forming shallow inundated areas of various lengths. They are more common on the north- than the central- and south coast. In some areas like Al Luhayah and Midi, the khors are particularly extensive with permanently flooded inlets often used as landing sites for fishing boats. Mangrove stands were reported at different localities along Yemen Red Sea

coast in: Midi to Al-Luhayah, Midi fish landing site, between Midi and Al-Habl I, between Midi and Al-Habl II, between Midi and Al-Habl III, between Midi and Al-Habl IV, between Midi and Al-Habl V, Al-Habl, Al-Buhays, between Al-Buhays and Al-Luhayah, North of Al-Luhayah, Al-Luhayah, South of Al-Luhayah, Al-Khawbah to Ras Isa, South of Al-Khawbah Ibn Abbas, Al-Harounia, between Al-Harounia and Al-Salif, Kamaran Island , Al-Urj to Al-Hudaydah, Al-Urj, North of Al-Hudaydah, Al-Hudaydah islets and South of Al-Hudaydah to Al-Ghurairah (Bab al-Mandab), between Al-Ruays and Yakhtul , South of Al-Makha,Between Al-Kadaha and Al-Ubaidah, Al-Ghurairah

5. Djibouti

Avicennia marina is the most abundant mangrove species and it was reported in all mangrove areas in Djibouti. Relatively thick and well grown Rhizophora mucronata stands coexist in three areas including Godoria, Khor Angar and Moucha Island. Mangrove stands were reported at different localities along Djibouti coast in: Ras Siyyan, Khor Angar, Godoria, Obock, Moucha and Maskali Islandsand Gaan-Maan.

Mangrove distribution along Arabian Gulf

The Arabian Gulf coastlines are dominated by only one species of mangroves, Avicennia marina. The processes of osmoregulation and salt secretion allow Avicennia marina to cope with hypersalinity conditions in the Arabian Gulf (Dodd et al., 1999). Mangroves are largely distributed along the southern shores of the Arabian Gulf. Dense growth of mangroves is particularly confined to low wave-energy and sheltered coastal areas along the coastlines of United Arab Emirates, Saudi Arabia and Qatar. While mangroves are relatively widespread throughout the Arabian Gulf countries, there are variations in their distributions from one country to another. For instance, the total extent of mangroves in the United Arab Emirates is estimated to be 38 km2 (Dodd et al., 1999) compared with only 0.31 km2 in Bahrain (Abido et al., 2011).

According to the IUCN Red List of Threatened Species (RLTS), the mangrove species occurring in the Arabian Gulf are classified as of 'Least Concern'. This Red List assessment concluded that although there are overall range declines in many areas, they are not enough to reach any of the threatened category thresholds. However, it can be argued that this classification might not be applicable at the country level in the Arabian Gulf, particularly for Bahrain. It is recognized that the IUCN RLTE categories and criteria provide objective framework for the classification of studied species. However, these categories and criteria of the RLTS

are primarily designed for global taxon assessments at species level, not at ecosystem level (IUCN, 2012).

1. Saudi Arabia

Mangrove forests are found in the form of fragmented stands in many tidal areas on the Arabian Gulf coast, south of latitude 26° north. They consist mainly of Avicennia marina trees. On the coast of the Saudi Arabian Gulf Rhizophora mucronata is very rare. They grow mostly at the outflow of fresh water streams where silt and organic material are carried out by the water runoff from the valleys to the shore of the Gulf. Mangrove ecosystems are limited along the Arabian Gulf and they are confined to the Damman area (Tarut Bay) with well developed communities consisting of Avicennia marina, and in Gurmah Island. Two mangrove planting sites were established in 1981 in Al Khafji both planted with Avicennia marina. Some smaller plots of Rhizophora stylosa Griff., R. mangle L., Lumnitzera racemosa Willd.(and Bruguiera gymnorrhiza were also laid out. In the Arabian Gulf mangrove ecosystems have been negatively affected by the large oil spill from the Gulf War.

2. Qatar

The mangrove forests in Qatar are mainly located in the northern part of the Al-Khawr area, where the vegetation plays an important role in the shaping of the beach. Mangroves also border the Khor Dhakhira stretch.

3. Oman

One of the largest mangrove forests in Oman is located in Qurm (Muscat). The forest structure is simple; Avicennia marina dominates and reaches from 2 to 6 m in height along the Gulf of Oman.

4. Kuwait

Mangroves do not occur naturally in Kuwait but an introduced species has been planted in recent years. Propagules of Avicennia marina have been collected from natural stands in Bahrain and United Arab Emirates and planted with positive results, reaching a mean height of 2.5m, after seven years of growth, which is close to the height of the parent trees in Bahrain.

5. Iran

Mangroves forest in Iran can be found in the tidal zones of the sea of Oman. They are composed by Avicennia marina and Rhizophora mucronata, the first of which forms a dense forest in the intertidal zones where it is possible to find bushes and

trees from 3 to 6 meters in height. The diameter of the trees can reach 40 cm. Rhizophora mucronata, dominates near Sirik, in a mixed forest with A.marina. Originally there were about 200,000 hectares of Avicennia marina forests, but they have suffered a strong decline over the years.

6. Bahrain

The only mangrove forest present in the country is located in Ras Sanad, at the southern part of Tubli Bay, an inshore coastal area situated in the north-east of Bahrain. The mangrove stand was designated a nature reserve in 1988. Avicennia marina is the sole species found, the highest mangrove tree being approximately 3.5 m tall.

Ecosystem connectivity, climate change and human wellbeing

Mangrove forests trap sediments from inland areas, reducing siltation of seagrasses and coral reefs. In addition, they serve as buffer zones between land and the sea, as they regulate fresh water output by evapotranspiration systems, protecting corals and coastal forests from high variations in salinity. Coral reefs act as a barrier against strong waves, thereby protecting seagrasses and mangroves, while reef erosion creates sediment for the growth of seagrass colonies in lagoons. Coastal ecosystems are intrinsically interconnected among themselves and even with more distant ones. The ecological integrity of each ecosystem thus directly and indirectly depends on the status of other ecosystems. These linkages ensure ecological exchanges among the different ecosystems and their components, as many marine organisms migrate from one ecosystem to another during their life cycle. Human pressures have led to the degradation of coastal habitats' resources putting the very livelihoods of coastal communities at risk. For instance, deforestation and poor land use practices upstream lead to massive sedimentation downstream, impacting on mangrove, coral and other ecosystems (Kitheka et al., 2002 c&d; Bosire et al., 2006). Coastal ecosystems need to be managed in an integrated way if they are to continue providing goods and services to support life and human welfare. By providing an updated picture of the status and conditions of coastal and marine ecosystems, and their close link to human wellbeing, it is hoped that this publication will contribute towards the design of more holistic and rational approaches to environmental management in Arabic countries.

As human activities along the gulf and Red Seas coasts increase, they exert distinct pressure on the shoreline. The loss of coastal land and associated infrastructure through coastal erosion is a recurrent and widely reported problem in the re-

gion. Shoreline erosion poses a continuous threat to infrastructure, necessitating expensive engineered coastal protection measures and sometimes even the abandonment of hotel developments. Shoreline change causes destruction to fishing grounds, fish landing sites, beaches, turtle nesting areas, and properties adjacent to the shoreline.

Climate change will place coastal populations and infrastructure at risk from sea-level rise and coastal storms. Low-lying areas will be the most affected by sea level rise. This is already becoming a perennial problem in many area of the Gulf and along the Red Sea. Much of the research suggests that climate change will exacerbate vulnerabilities in these areas, adding to the substantial challenges of poverty reduction and sustainable development in some areas along Red Sea.

The United Nations Framework Convention on Climate Change entered into force in 1994, with a major objective being to achieve the stabilization of greenhouse gas emissions and to identity national adaptation strategies. Among other recommendations, Article 4 of the Convention commits nations to develop integrated plans for coastal zone management as part of their adaptation strategies. To prevent climate change from eroding the benefit of development, there is need for a strategy that incorporates management of risks associated with climate change into broader development programs by putting into perspective the areas likely to suffer the most from the impacts of climate change, and recommending the required actions.

Conclusion and Recommendations

Country- and Sectoral approaches to address issues related to perceived problems in the coastal and marine environment have not yielded the desired results. For example to stop mangrove degradation and attempts to promote conservation for new protected areas in mangroves ecosystems. There is a need to link the various approaches with each other and with other development activities, through an effective Integrated Coastal Zone Management (ICZM) programme. Key recommendations for such an ecosystem approach are summarized in the following:

- Promote Mangroves Ecosystem restoration Programmes in the region
- Nominate New Marine protected areas specially for Mangroves sites.
- Ensure Political goodwill and public education
- Apply Climate change adaptation measures.
- Develop and enforce Specific Legislation for conservation of coastal and marine habitats.
- Mitigate threats from land-based activities.
- Mitigate threats from unsustainable fisheries
- Invest in Capacity building and financing for ICZM sectors.
- Adopt and apply integrated Land use planning policies.
- Monitor impacts and mitigate Oil and gas exploration especially in the Gulf region.

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THE SECOND INTERNATIONAL FORUM
OF THE QUR'ANIC BOTANIC GARDEN
ISLAMIC PERSPECTIVES ON ECOSYSTEM MANAGEMENT

Exploring Opportunities and Challenges
in Ecosystem Management

INSPIRATION IN A BUSINESS MODEL FOR ECOSYSTEM RESTORATION: FOUR RETURNS FROM LANDSCAPE RESTORATION

Mr. Willem Ferwerda

Mr. Willem Ferwerda
CEO and founder of Commonland Foundation
Executive Fellow Business and Ecosystems, Rotterdam School of Management - Erasmus University (Netherlands)
Special Advisor Business and Ecosystems, IUCN Commission on Ecosystem Management (Switzerland) www.commonland.com
Email: willem.ferwerda@commonland.com

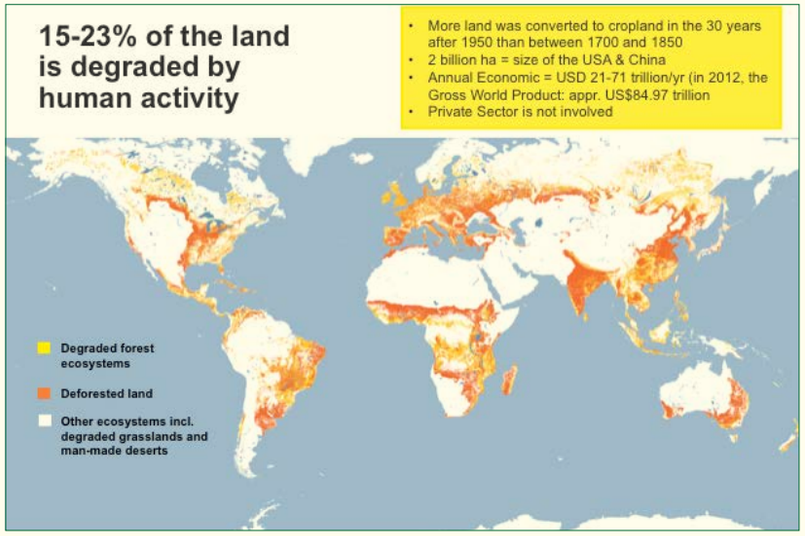
Abstract

More than 2 billion hectares of ecosystems are severely degraded. The need to restore these degraded ecosystems, the tragedy of the commons, is of global importance in this century. Governments and NGOs do not have sufficient resources nor the skills to scale this up. To involve business and investors a common understanding needs to be created, that includes four returns instead of only one: the return on investment (ROI). A four returns business model is developed on an ecosystem level, that combines ROI, with natural and social capital with an innovative people approach: the return of inspirational capital: the way of the heart. Active involvement in ecosystem restoration results in a process of understanding the inner purpose of all stakeholders. When well managed and guided the restoration and rehabilitation of three landscaping zones (natural, mixed and economic) give four returns during a period of at least 20 years.

1. Introduction

According to scientists of the Stockholm Resilience Centre, mankind is rapidly approaching the boundaries of the productive ecological capacities of the planet. Nobel Prize-winning atmospheric chemist, Paul Crutzen, describes society as having entered a new geological period called the Anthropocene, in which human activity has significantly impacted and influenced earthly natural events including a severe impact on Earth's ecosystems. Business as usual has led to the degradation of ecosystems and biodiversity loss worldwide. This is creating a threat to human well-being, the global economy, trade and society.

In terms of hectares, 2 billion have been degraded already (China and the United States combined). On a yearly basis an estimated USD 4,3 – 20,2 trillion have been lost due to the conversion of ecosystems (in 2012, the Gross World Product: approximately USD 84.97 trillion) (Costanza et al., 2014). Also very important is that is causes a loss of self-reflection of man and purpose.



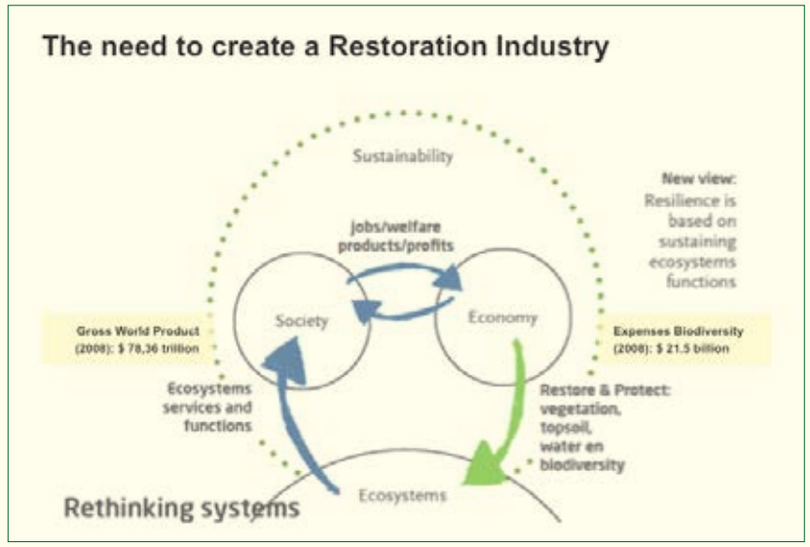
Source: World Resources Institute, Global Partnership on Forest and Landscape Restoration

Just as we now recognize that our activities are a major cause of the problems associated with this era, we are also in a position to play a key role in the solutions necessary to reverse the damage done. But how and where do we start? Insights from, and personal experiences with specialists and local people in the fields of ecology, agriculture, economics, sociology, business, governance and finance have all contributed to this paper, clearly indicating the way to a systemic solution.

2. Beyond technical innovations

Solving the ecological crisis requires more than technical innovations. It requires the integration of knowledge and experiences of different stakeholder groups who have established a clear vision of a sustainable future, whereby economic activity operates within the functional boundaries and capabilities of the planet. Silos need to be broken down and we need to accept our interdependence and interconnectedness with each other and ecosystems functions.

In economic terms, this requires us to shift from a linear understanding of finance and business activity to one that is cyclical (feedback loops) in principle and operation, and based on a solid understanding of how natural systems work. It is imperative that we restore the mutually beneficial relationship between mankind and nature and meanwhile move towards a circular economy (Circular Economy, 2014).



Source: Ferwerda, W. (2012): Nature Resilience: ecological restoration by partners in business for next generations. IUCN CEM, RSM

The Triple P (Planet, People, Profit) philosophy in the nineties has encouraged the idea that reducing your impact is sufficient. This has led to important steps in sustainability, but no changes in issues like biodiversity loss and conversion of natural ecosystems: major degradation of the planet continues and has increased. Ecosystems are the basis of our socio-economic systems. The conclusion must therefore be that the present Triple P model does not work in advancing the preservation and restoration of ecosystems. We need to adopt a new model where ecosystems form the fundament of our planetary resilience. We need to go from

'Triple P' to restoration and protection of 'Planetary Resilience' and understand that Ecosystems are Economics. This implies that companies should not only work on lowering their unsustainable impacts, but also on scaling up their positive impacts by 'giving back' to nature – through ecological restoration in partnership with other stakeholders. We need to create a restoration industry.

3. Scaling up restoration

In order to achieve significant results in terms of scaling up 'ecosystem restoration' projects and programmes, we need to take into account the following enabling factors:

1. The definition of 'ecosystem restoration' needs to be co-created, single, short, understandable and concise;
2. Intergenerational sustainable profit models (with a 20-40 year time-frame) need to be stimulated;
3. Simple and effective guidelines and criteria need to be used and solutions should be developed together;
4. New and surprising partnerships need to be actively created;
5. A common language needs to be developed and promoted worldwide, that includes people's inner reflections: inspiration.

Accelerating restoration means we need to have a common target that enables all stakeholders to come out of their silos and work together. Such a target should be clear, attractive and realistic. The Bonn Challenge seems to the best agreement that addresses a restoration agenda (IUCN, 2014). Its core commitment is to restore 150 million hectares of lost forests and degraded lands worldwide by 2020 and it was launched at a ministerial conference in Bonn in September 2011. Additional from the business side, Action 2020 that was launched in 2013 by the World Business Council on Sustainable Development also addresses ecosystem restoration.

Although there are enormous opportunities for increasing food, biodiversity, water security and the accumulation of biomass in the top soil by recovering lost functionality in production landscapes, not one global initiative or consortium has succeeded in involving the business sector in large scale restoration of degraded lands and biodiversity. This is particularly serious, given the urgent need to scale-up and accelerate ecosystem restoration as it is connected to alleviating poverty in many developing countries (UNEP, 2010). We urgently need the power of the private sector to scale-up. The challenge is how to convince companies to step up.

4. A solid business case

Besides the Bonn Challenge's aim to restore 150 million hectares of degraded land, an IUCN analysis presented at Rio+20 in 2012 shows that once restored, 150 million hectares would pump more than $ 80 billion into national and global economies and close the climate change 'emissions gap' by 11-17%. Based on data presented by the TEEB studies (2010, see picture below) a mean of investment is needed per hectare of US$ 2,390 ('other forests'). For the restoration of 200 million hectares, the sum needed is US$ 478 billion or about € 450 billion over 20 years. That's approximately € 2.25 billion a year. The business case for conservation is difficult to find while ecosystem restoration has a potential high benefit-cost ratio.

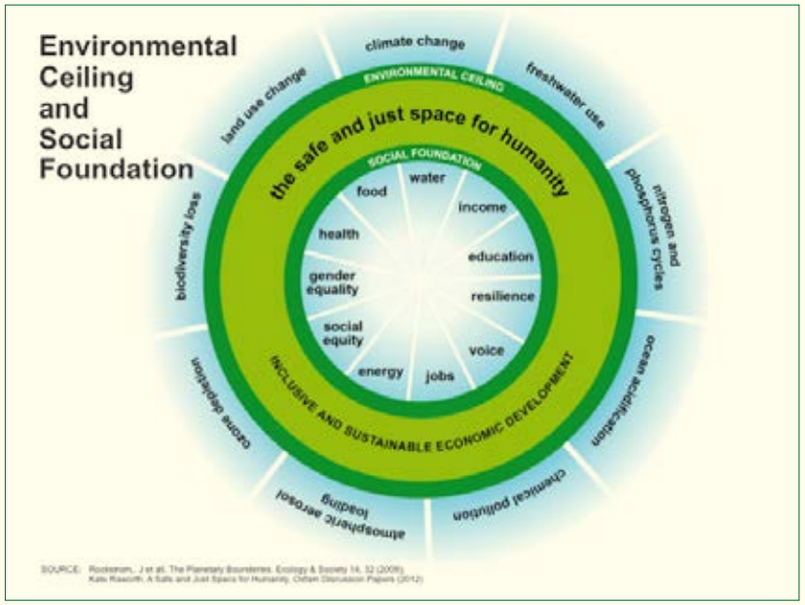
Table 3: Estimates of costs and benefits of restoration projects in different biomes

	Biome/Ecosystem	Typical cost of restoration (high scenario)	Estimated annual benefits from restoration (avg. scenario)	Net present value of benefits over 40 years	Internal rate of return	Benefit/cost ratio
		US$/ha	US$/ha	US$/ha	%	Ratio
1	Coral reefs	542,500	129,200	1,166,000	7%	2.8
2	Coastal	232,700	73,900	935,400	11%	4.4
3	Mangroves	2,880	4,290	86,900	40%	26.4
4	Inland wetlands	33,000	14,200	171,300	12%	5.4
5	Lakes/rivers	4,000	3,800	69,700	27%	15.5
6	Tropical forests	3,450	7,000	148,700	50%	37.3
7	Other forests	2,390	1,620	26,300	20%	10.3
8	Woodland/shrubland	990	1,571	32,180	42%	26.4
9	Grasslands	260	1,010	22,600	79%	75.1

Source: The Economics of Ecosystems and Biodiversity (2009), as used in UNEP (2010). Besides these roughly estimated monetary gains (UNEP, 2010), there are other sound reasons to dive into the restoration business. Namely, it enables us to addresses the enormous challenges of sustaining business operations in terms of supply chain, new markets, reputation, social stability, engagement, positioning, jobs and new market developments. It is also about being prepared, as governments sooner or later will come with legislation. On a deeper level it is ethically sound and slowly some companies are starting to recognise that they have to take up this responsibility.

The time is also ripe as concrete solutions have been developed and are available for implementation. On the technical side this toolbox includes techniques such as permaculture, promising new water storage systems for tree planting such as the waterboxx and life land box, removal of invasive species, alluvial fans, biomimicry technology, biochar (converts agricultural waste into a soil enhancer that can hold carbon, boost food security and discourage deforestation) and the replanting of indigenous species that help to restore the hydrological ecosystem base. There are also sophisticated social tools available, such as the Theory U (Scharmer, O. 2008), a co-participatory, trans-disciplinary approach, that enables people to understand their inner process and which are imperative for enabling the success within the envisaged restoration industry.

In many societies materialistic gain and urban migration are the trend. A parallel process is that Business as Usual strives for the maximization of Return on Investment per hectare and that leads to biodiversity loss, soil depletion, overgrazing and clear cutting, and finally to losses of jobs in rural areas. However we see also another trend: in many countries leading decision makers and 'think tanks' observe that these social and environmental processes are connected, or in other words: our environmental ceiling is reached, and our social foundation relies entirely on ecosystem services. The 'donut model" below is making this visible:



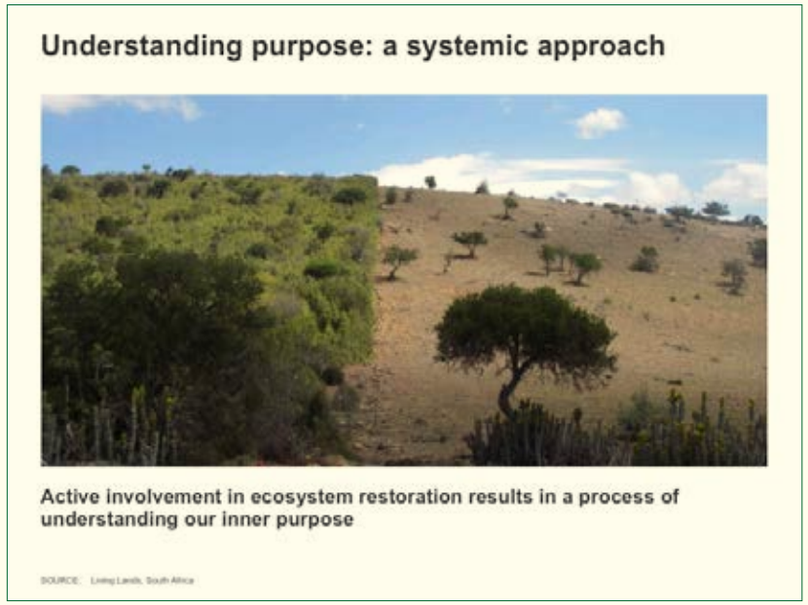
Environmental Ceiling and Social Foundation: a safe and Just Space for Humanity, according to Raworth (2012).

So a business case should deal with three issues: people, nature and finance. However, before we continue we first need to understand why business is not involved in scaling up landscape restoration activities at all. Is it only about too high risks, lack of ROI, or that they just don't understand ecology? What are the obstacles? The following five obstacles (and opportunities) can be identified why business is not involved:

Obstacles and opportunities to involve business ecosystem restoration

The most important obstacle is to address the 'silo thinking' that many stakeholders have. It is the reason that we need to look in the underlying causes of people's behavior. How can people be motivated to act; what is their deeper motivation, or what makes them happy to participate. This has all to do with awakening the inner purpose, and that is more of a spiritual process. So how do we include this in a business model? Here the spiritual component enters: how someone is touched. Understanding the systemic landscape approach adds exactly that other dimension: that of inspiration, the way of the heart. Active involvement in ecosystem restoration results in a process of understanding our inner purpose. If man can see nature as the perfect reflection of a creator, God, the degradation of nature hurts our inner self. For many people restoration is a proces of healing their inner self. It is why restoring ecosystems is often well received and recognized in all cultures and religions around the globe.

We have therefore included Return of Inspiration in our business model as an important component at the start and during the whole restoration process of 20 years.



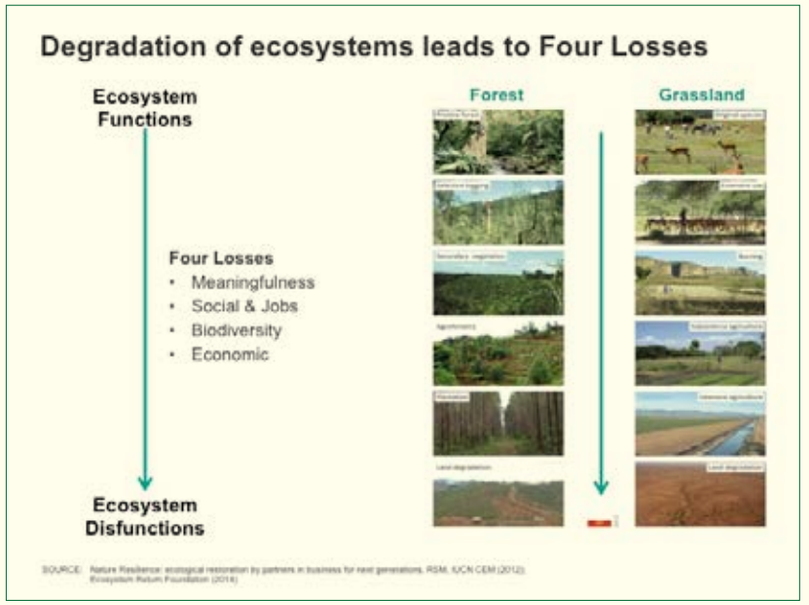
Source: Baviaanskloof, South Africa (Photocredit: Living Lands)

4. Four returns, three zones, 20 years

The pieces are present, now we need to bring them together. Based on the above mentioned assumption that the degradation of ecosystems leads to many losses, the solution to involve finance, business and local people to restore degraded ecosystems should be systemically holistic, inspiring and make use of one common language that everyone understands. Or in other words: it should be adaptable to different cultures, be people as well as business orientated. It means that the entrance should be inspirational but with a perspective to act.

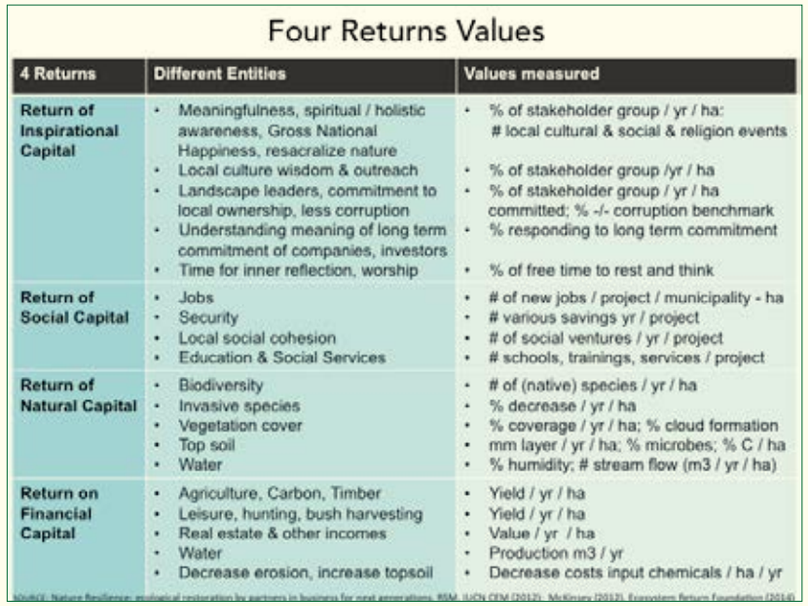
In the long run, maximization of the return on investment (ROI) per hectare leads to ecosystem degradation. Basically this creates four losses: meaningfulness, jobs, biodiversity and economy.

Those losses increase over time if functional ecosystems that are providing ecosystem services, are degrading to dysfunctional ecosystems that do not provide these services anymore.



By turning this around, successful restoration partnerships should be based on maximization of four returns per hectare based on an integrated 3-zones approach. Underneath you will find the composition of the four returns:

- Inspirational capital: meaningfulness, spiritual/holistic awareness, Gross National Happiness, resacralize nature, local culture, wisdom and outreach, landscape leadership, commitment to local ownership, less corruption, understanding meaning of long term commitment of companies, investors, time for inner reflection, worship
- Social capital: jobs, security, social cohesion, education and social services
- Natural capital: fertile soils, fresh water resources, biodiversity, biomass and carbon storage, vegetation cover
- Financial capital: agriculture, carbon, timber, leisure, hunting, bush harvesting, real estate and other incomes, water, decrease erosion, increase topsoil, communication, marketing, subsidies



Four Returns Values

4 Returns	Different Entities	Values measured
Return of Inspirational Capital	• Meaningfulness, spiritual / holistic awareness, Gross National Happiness, resacralize nature	• % of stakeholder group / yr / ha: # local cultural & social & religion events
	• Local culture wisdom & outreach	• % of stakeholder group /yr / ha
	• Landscape leaders, commitment to local ownership, less corruption	• % of stakeholder group / yr / ha committed; % -/- corruption benchmark
	• Understanding meaning of long term commitment of companies, investors	• % responding to long term commitment
	• Time for inner reflection, worship	• % of free time to rest and think
Return of Social Capital	• Jobs	• # of new jobs / project / municipality - ha
	• Security	• # various savings yr / project
	• Local social cohesion	• # of social ventures / yr / project
	• Education & Social Services	• # schools, trainings, services / project
Return of Natural Capital	• Biodiversity	• # of (native) species / yr / ha
	• Invasive species	• % decrease / yr / ha
	• Vegetation cover	• % coverage / yr / ha; % cloud formation
	• Top soil	• mm layer / yr / ha; % microbes; % C / ha
	• Water	• % humidity; # stream flow (m3 / yr / ha)
Return on Financial Capital	• Agriculture, Carbon, Timber	• Yield / yr / ha
	• Leisure, hunting, bush harvesting	• Yield / yr / ha
	• Real estate & other incomes	• Value / yr / ha
	• Water	• Production m3 / yr
	• Decrease erosion, increase topsoil	• Decrease costs input chemicals / ha / yr

SOURCE: Nature Resilience: ecological restoration by partners in business for next generations, IBSM, IUCN CEM (2012), McKinsey (2012), Ecosystem Return Foundation (2014)

In every restoration project or program, three landscaping zones are defined:

- A Natural Zone for restoring the ecological fundament and biodiversity. In this zone there will be - in the end - rich biodiversity, soil for ecosystem services; carbon sequestration, forest products, and opportunities for leisure and hunting.
- Eco Agro Mix Zone rehabilitation areas and restoring the topsoil and delivering low economic productivity. In this zone there will be - once completed - partially restored biodiversity; soil recovery, carbon sequestration and timber supply by agroforestry, fruit trees, water supplies, and opportunities for leisure.
- Economic Zone designed for delivering high economic productivity. In this zone there will be – after completion - productive zones for sustainable agriculture and dedicated zones for real estate and infrastructure.

'Every tree and plant in the meadow seemed to be dancing, those which average eyes would see as fixed and still.' Rumi

Three landscape zones in Baviaanskloof, South-Africa, june 2014
(Photocredit: Mr. Willem Ferwerda).

The restoration of such (interconnected) zones as parts of one plan creates landscapes in which an increase of biodiversity and vegetation cover will go hand in hand with newly developed agricultural lands. Within those mosaic landscapes ecological, sustainable agricultural and economic zones will co-exist in an ecological balance.

The Ecosystem Restoration Partnerships require a long time horizon, combined with the flexibility to constantly develop creative solutions to complex stakeholder challenges. Restoration should be based on integrating purpose in a business model for ecosystem restoration partnerships. The approach is tailor made but always focused on optimization of Four Returns per hectare.

5. Long-term collaboration

Ecosystem Restoration Partnerships will only be successful if stakeholders collectively understand that we all together created results nobody wanted: degraded landscapes. Meeting these challenges requires updating our economic logic and operating system from an obsolete "ego-system" focused entirely on the well-being of oneself to an eco-system awareness that emphasizes the well-being of the whole. Participation and co-creation are essential to guarantee long-term successful multi-stakeholder processes.

Ecosystem Restoration Partnerships should take at minimum 20 years (one generation), or at least ask for a four-stage (4x5 years) commitment. While institutional investors such as pension funds will not soon become available, the game changers in a new restoration industry should come from family offices, impact investors, (local) governments and landowners. They can build up a track record with their patient capital and prepare the ground for institutional investors.

6. Systemic business development

Scaling up ecosystem restoration involves the following steps/activities, to be coordinated by a business developer:

1. Selecting Four Returns projects: identifying and selecting existing small-scale restoration initiatives, with potential to be scaled-up, based on the Four Returns approach.
2. Bottom-up stakeholder engagement process: development of the business model for each selected project based in cooperation with all partners, using inspirational stakeholders principles (Theory U), and based on long lasting (20 years or more) commitment of all parties.

Source: Living Lands and Presencing Institute (Harvard MIT)

3. Developing Restoration Company: actively creating an Ecosystem Restoration Partnership by matching companies, investors, people and local organizations and develop it in Operational Restoration Companies, based on four returns

4. Organizing Financial Investment: establishing an Ecosystem Restoration Investment Fund that invests in those operational companies
5. Monitoring progress and communicating: visually documenting and communicating projects and connects (the actors in) a specific project to a wider local network and international partners

Scaling up means that a Four Returns Business Developer is needed to identify existing and promising 'ready to scale up' restoration projects while keeping track with a group of potential interested investors and companies.

7. Conclusion

There is good news amidst the constant flow of distressing messages concerning environmental crises: we can massively restore ecosystems. The technology exists, the science is available and the financial resources are ready to be uncapped. Projects such as the Chinese Loess Plateau Watershed Rehabilitation Project that was started by the World Bank and Chinese government in 1995, provides a practical example of how this can be successfully achieved.

Landscape restoration and rehabilitation at the Loess plateau in China. Above: September 1995; Below: September 2009.
(Photocredit: Kosima Liu, EEMP, China).

But it takes time and trust. What is needed are governments, companies and other stakeholders who are interested in long-term, intergenerational projects instead of short-term, lackluster activities that achieve no real impact in terms of sustainability. By widely adopting Four Returns the spiritual, currently disconnected relationship between humans and nature can be re-established. The recently

founded Commonland Foundation is working with its partners to realize the up scaling of these projects based on the four returns approach.

'If we could see the miracle of a single flower clearly, our whole life would change.' Buddha

Acknowledgements

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THE SECOND INTERNATIONAL FORUM
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ISLAMIC PERSPECTIVES ON ECOSYSTEM MANAGEMENT

Exploring Opportunities and Challenges
in Ecosystem Management

A CASE STUDY FROM NORTH AMERICA: PUBLIC-PRIVATE COLLABORATION IN MANAGEMENT OF WALLOWA WHITMAN NATIONAL FOREST

Dr Stephen R. Edwards

Dr Stephen R. Edwards
Commission on Ecosystem Management
International Union for Conservation of Nature (IUCN)
Email: prxs@me.com

Introduction

This case study is about a collaborative process and the role it is playing in building trust and understanding amongst diverse stakeholders to promote management and conservation of the Wallowa-Whitman National Forest. Development of the collaborative, the motivations/interests behind the different stakeholder engagements, and how the collaborative is influencing the decision-making process in the US Forest Service. Two large forest management initiatives: "Lower Joseph Creek" and "East Face" are the focus of the case study.

The Wallow-Whitman National Forest (Figure 1), located in the Blue Mountains, is 9,682 km² (3,738 sq miles), spanning three counties. It is larger than the states of Rhode Island or Delaware, yet the populations of the counties remain relatively small, totaling around 50 thousand people, with a little more than half of them concentrated in the counties' administrative centers. Ecologically the forest is characterized by drier conditions and slower growing trees, including Ponderosa Pine, Douglas Fir, White Fir, Grand Fir, Lodgepole Pine, Engelmann Spruce, and Western Larch in varying proportions depending on local environmental conditions.

Figure 1. Map of the Wallowa-Whitman National Forest

Historically timber harvests were a significant economic driver in the region, providing incomes to local loggers and truckers, saw mills and their workers, and tax revenues, which contributed substantial funds to local school districts. The infrastructure, which relies heavily on predictable timber harvests from public lands was also crucial for private landowners to manage their woodlands, and ensured those harvests contributed to local economies.

In addition to the economic benefits derived from forest management, the Blue Mountains provide a wide array of environmental services on which local populations depend, including artisanal harvests of non-timber forest products, including mushrooms, medicinal plants, berries, and firewood; recreation, involving hunting, fishing, hiking, and the spiritual experience most local residents convey when the talk about walking in the woods or "communing with nature".

The forests are something more than simply trees. They are central to the way of life of the local people. In addition to the Provisioning and Cultural Services (see Box 1) the mountains and the forests play crucial roles in soil conservation and sustaining a water supply necessary for the primary industry of the region – agriculture.

The Millennium Ecosystem Assessment (2005) identified 24 different categories of services that are provided by ecosystems. These are listed in Box 1. Those highlighted in yellow are specific services presently provided by the ecosystems comprising the Wallowa-Whitman National Forest, on which all people in the region depend for their livelihood security.

Issues and Challenges

In the mid 1990's forest management on public lands was altered substantially

Box 1. Millennium Ecosystem Assessment ecosystem services (highlighted services are provided by the Blue Mountains)

Provisioning Services (Products obtained from ecosystems)	Regulating Services (Benefits obtained from regulation of ecosystems)	Cultural Services (Nonmaterial benefits obtained from ecosystems)
Food	Air quality regulation	Spiritual and religious values
Fresh water	Climate regulation	Aesthetic values
Fiber (including timber)	Disease regulation	Recreation & Ecotourism
Biochemical	Erosion Regulation	Inspirational Values
Genetic resources	Pest regulation	Educational opportunities
	Water regulation	Sense of place
	Water purification	Cultural heritage
	Pollination	
Supporting services (Services necessary for the production of all other ecosystem services)		
Soil formation		
Nutrient cycling		
Primary production		

increasing influence from the environmental community. Since it's founding in 1905 the Forest Service pursued a mandate focused on harvest of timber to meet an ever-increasing demand for building materials. When founded the supply seemed endless. Annual harvest quotas were established that each National Forest was to fulfill. Demand seemed to dictate harvest levels. While they were based on sustainability models by the mid 1980's, it was increasingly difficult to meet the harvest quotas in many National Forests, while ensuring adequate habitat for a variety of species under threat.

Under growing pressure from environmental organizations rules were adopted by the Forest Service that effectively changed the course of the Forest Service dramatically – from a timber management agency to a forest conservation agency.

The Wallowa-Whitman National Forest Land and Resource Management Plan was adopted in 1990, which provides the standards and guidelines for all forest

management in the National Forest. These standards and guidelines reinforced the shift from an agency responsible for delivering a quota of timber each year to an institution mandated to conserve the National Forests to ensure that they are capable of meeting a wide range of needed services, including timber harvests.

In 1994, the Forest Service Pacific Northwest Region regional forester issued "Interim Direction Establishing Riparian, Ecosystem, and Wildlife Standards for Timber Sales on Eastside Forests", commonly referred to as the "Eastside Screens" (U.S. Department of Agriculture, Forest Service. 1994). In 1995 the 1990 Forest Plan was amended to incorporate the Eastside Screens. They provided strict standards and guidelines designed to secure old growth habitat critical to the survival of the Northern Spotted Owl, other birds and mammals and certain fish species. Under these rules trees greater than 21 inches in diameter (at breast height) could not be harvested. The 21-inch rule was a proxy for age. The intent was to preserve trees 150 years and older. To preserve riparian habitat, no trees could be harvested within 150 feet on each side of permanent non-fish bearing streams and 300 feet on each side of permanent fish bearing streams (U.S. Department of Agriculture, Forest Service. 1995).

Most local citizens believe that the "Eastside Screens" was the death knell of the timber industry in eastern Oregon. As mills no longer were able to process larger diameter timber they found it progressively more difficult to make a profit and one by one they closed. In Baker County six mills closed after the imposition of the Eastside Screens. Today, there is only one large mill remaining in the three counties the Wallow-Whitman National Forest spans. The result is increased costs to transport logs to the mill and with reduced competition prices mills paid for timber remained low. By 2008, timber harvests on private land were significantly reduced. Because of the high transportation costs and the income was not sufficient costs could not even be met. The only significant harvests that continued were infrequent harvests from public lands, where the Forest Service subsidized logging operations, and from large tracks of forested land that the mill owned.

In addition, as the Forest Service proceeded to develop forest restoration projects under the more rigorous standards and guidelines of the 1990 Forest Plan Non-Government Organizations became more aggressive in challenging proposed actions. While some of these challenges were resolved at the Forest Supervisor level, many ended up being settled in the courts. To begin with, these restoration projects took years to develop because of the stricter conditions that had to be met, including: publishing a statement outlining the purpose and need for the project; collecting and analyzing comments from the public (from any citizen in the United States); identifying a concise set of issues based on public

comment; designing a set of alternative management options that responded in different ways to these issues; assessing the environmental impact of the different alternatives actions; and making available the proposal for another round of public comment – which often focused on reviews of the different options. If a project was challenged and ended up in the courts, it added more time.

Proposed restoration plans, with the background information, alternative options for treatment, and reviews of pertinent standards and guidelines are several hundred pages long and cost the Forest Service a lot. A District Ranger told me that the average cost was around USD 1,000,000 to develop a restoration project proposal, from start through the public comment period. Any costs to defend the project in court and revising the project to respond to court decisions could add substantially to the overall cost. These costs and the time required to manage the process from beginning to end, which now was taking years, meant fewer restoration projects were being developed and from an environmental perspective the state of the forest was deteriorating.

Lack of management in the public forests fostered conflict amongst stakeholders and between different sectors in the public and between public sectors and the Forest Service. Those who have a high reliance on the forest for income and provisioning and cultural services (see Box 1 above) lost trust in the Forest Service to manage the forest effectively and became progressively frustrated over the rules and decisions that seem to be taken with little or no consultation with local people. At the same time, local non-government organizations, advocating for the "rights" of the forest ecosystems in the face of over exploitation, also became targets to blame for the lack of management of the forests because of their interventions.

More fundamentally, lack of management combined with over aggressive wildfire control, has resulted in forests that are at very high risk of ecological collapse:

1) The volume of understory vegetation has increased to the point in some areas where a person cannot walk more that a meter in a straight line. In extreme situations it is not possible to enter the forest at all.
2) The increasing number/density of trees increases the competition amongst them, resulting in stunted growth and important understory species are unable grow in these conditions.
3) As the density in the forest increases, shade tolerant species (e.g., White or Grand Fir) thrive, overtaking the historically dominant species (Ponderosa Pine). As the Fir are faster growing, but shorter lived (80 to 100 years) the overall ecology is shifting.

Figure 3. Over dense forest conditions at high risk for wildfire and disease

4) Increased density of trees also increases vulnerability to beetle attacks and the spread of micro-mistletoe. Beetle attacks kill trees by effectively cutting off the flow of water in the Xylem. Even large trees can be killed in a few months. As the number of beetles increases the risk of loosing whole forest landscapes increases.
5) As the density of forest tree communities increases habitat for a wide range of species is affected.
6) From an economic perspective these dense, stunted forests have less potential value in timber and the cost to harvest usable timber from these areas is substantially increased.
7) Lastly, with increased density, and the shift from fire tolerant species like Pine to Fir, the risk of large-scale wildfires increases substantially.

Wallowa-Whitman Forest Collaborative

Within the Blue Mountains there are three National Forests: the Wallow-Whitman, Umatilla and the Malheur. In the latter the Blue Mountain Forest Partners Collaborative was formed in 2006 with support provided by a non-government organization – Sustainable Northwest.

Table 1. Number of Appeals to Proposed Treatments in the Wallowa-Whitman and Malheur National Forests[1]

Year	Wallowa-Whitman National Forest		Malheur National Forest	
	Number of Treatments/ Actions	Number of Objections/ Appeals	Number of Treatments/ Actions	Number of Objections/ Appeals
2013	1	2	1	2[2]
2012	4	14[3]	-	-
2011	2	3	-	-
2010	4	5	-	-
2009	2	5	-	-
2008	-	-	2	5[4]
2007	1	1	-	-
Totals	**14**	**30**	**3**	**7**

The record of achievements substantiate the remarkable success this collaborative has had. Table 1 compares the number of treatment/actions proposed and the number of objections/appeals filed between 2007 and 2013 for the Wallowa-Whitman and Malheur National Forests. The numbers are significantly smaller for the Malheur National Forest, which means that more acres were treated, more timber was going to mills and contributing to local economies and less energy was being spent resolving conflicts.

[1] Records cited on USFS website: http://www.fs.fed.us/appeals/index.php

[2] The two objections were withdrawn following negotiations with the Forest Supervisor

[3] An additional 465 objections were filed concerning proposed new rules governing transportation within the National Forest.

[4] All five objections were withdrawn following negotiation with the Forest Supervisor.

Box 2. Record of Malheur National Forest treatment actions:

Between 2006 and the September 2014 with the support of the Blue Mountain Forest Partners the Malheur National Forest, with no litigation:	
Completed planning for 14 projects covering approximately 274,000 acres. These projects are in varying stages of implementation from just starting to almost complete; and	Undertook the only successful post fire recovery (fire salvage) project covering acres.

The record of forest management actions over the six-year span (Box 2[5]) reinforces the valuable role the collaborative played in building trust amongst stakeholders with varying positions, reducing conflict, and accelerating the treatments to restore resilience of forests at high risk.

Taking into account the success of the Blue Mountain Forest Partners, again with support from Sustainable Northwest, a process was put in place to establish a comparable multi-stakeholder body – The Wallowa-Whitman Forest Collaborative – in 2012. Its mission is: "To improve the social, economic, and ecological resiliency of the Wallowa-Whitman National Forest and local communities, through collaboration by a diverse group of stakeholders." About 70 people participated in the establishment of the Collaborative; however, the core group that continues to meet monthly is about 40 to 50 people. It could be argued that the science and knowledge base that guides forest management is substantial, and, while there is need for continued research, overall that knowledge resource is adequate to address most needs.

What has been lacking is the means to manage and engage with social systems to optimize the social capital in addressing the challenges of forest management. The core of the collaborative movement is its role in fostering trust across diverse spectra of stakeholders. In the Wallowa-Whitman Forest Collaborative, members represent county government, natural resource management specialists, conservation organizations, professional loggers, academic institutions, mills, and individual citizens' interests. To succeed the Collaborative must be transparent in its procedures and decision-making, that the members/participants in the social processes are patient, and that the group remain focused on the Collaborative's mission.

[5] Curtis Qual, Former US Forest Service Blue Mountain Forest Partners Collaborative Coordinator. Pers. Comm. 2014

Lower Joseph Restoration Project

The purpose of the Lower Joseph Restoration Project (Figure 2) is to "… restore, maintain, and enhance forest and rangeland resiliency to natural disturbances, protect natural resources at risk to uncharacteristic wildfires and insect and disease outbreaks, contribute to local economic and social vitality, modify fire behavior potential, and improve future forest, range, and fire management opportunities"

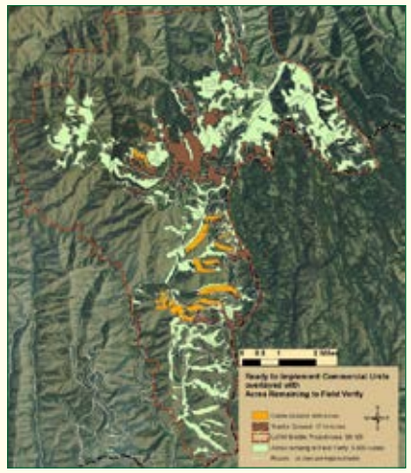

Figure 2. Lower Joseph project

In the published notice of intent to prepare an Environmental Impact Statement the Forest Service "characterized … [the area has having] … deep canyons with very steep, grass-covered side slopes interspersed with numerous exposed rock (basalt) layers" (US Department of Agriculture, US Forest Service. 2014). The forested areas are characterized as warm/moist (42%), warm/dry (about 30%), cool/dry (26%), and 4) small amounts of wet mixed conifer (<2%). The elevation ranges from about 1100 m (3600 ft) to 1500 m (5000 ft).

The published notice recognizes the important role diverse multiple stakeholders, including environmental organizations, timber industry representatives, local citizens, and country government, have played in development of background information/data on the status of the proposed treatment area.

The published notice underscores the need:

- To reduce "… differences between existing and desired ecosystem conditions … and desired ranges of variation in vegetation Conditions …" that were identified by the Wallowa County government, the Wallowa-Whitman Forest Collaborative, and other institutions e.g., state and other federal agencies, Native American Tribes.
- To "… restore and maintain landscape resiliency to fire-related disturbances, and [to] reduce risk of wildfire to human communities and infrastructure, which are goals of the National Cohesive Wildland Fire Management Strategy (2011).
- To promote consistency with the US Endangered Species Act to protect and restore Snake River steelhead and protection of water quality and waterways in the project area as required under the Clean Water Act of 1972.

- To provide benefits to local economies (e.g., forage, recreational opportunities, and timber and firewood harvests).

Projects are planned across 39,886 ha (98,561 acres):

1- 2,710 ha (6,696 acres) to enhance grazing capacity for livestock.

2- 3,664 ha (9,053 acres) to foster resilient forest structure and stand diversity.

3- 5,110 ha (12,626 acres) will be thinned to reduce fire risk

East-Face Restoration Project (Figure 3)

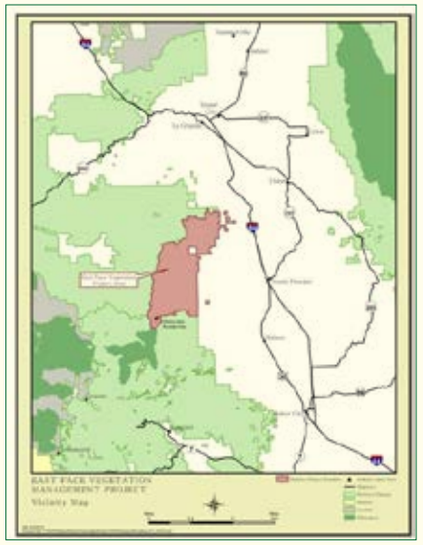

Figure 3. East Face Restoration Project

The project area covers 19,655 ha (48,569 acres), which spans two counties, and includes primary watersheds serving a number of communities. Current forest conditions reflect moderate to high risk for wildfires in a little over half of the area due to build up of large amount of understory vegetation which would serve as fuel for any fire that got established.

The collaborative identified seven needs that urgently needed attention in the project area:

- To restore and promote the historic range of variation in the forests across the planning area.
- To promote resilience to wildfire, insect predation and diseases and apply a cohesive wildfire strategy across all landownerships.
- To maintain and where possible to enhance threatened Whitebark Pine stands.
- To enhance the diversity and quality of habitat conditions to help reduce ungulate impacts on agricultural lands and improve wildlife habitat.
- To maintain and enhance connectivity of ecosystems by providing corridors.
- To maintain and enhance local communities and economies by providing a diversity of resource management activities, recreational opportunities, commodity outputs, and ecosystem services from public lands.
- To build and strengthen relationships amongst the Wallowa Whitman Forest stakeholders through a collaborative process that fosters mutual learning, ensures collective input and access to knowledge of the collaborative members, and helps develop understanding amongst stakeholders.

Outcomes

While the Wallowa-Whitman Forest Collaborative is a work in progress, and will likely require several years to achieve its goals, it is already making remarkable progress. A recent facilitated discussion involving Collaborative members explored four broad areas to measure progress to date.

Spatial area - The group concluded that the Collaborative is working at larger spacial scales than had been typical of other Collaboratives at this stage of their development. The group believed that this was possible, because of: 1) the pioneer work that had been done by volunteers who undertook extensive studies to substantiate the need for restoration work in the Lower Joseph project area; and 2) the lessons learned from other Collaboratives that have preceded establishment of the Wallowa-Whitman Forest Collaborative.

Timelines - The focus group felt that the Collaborative is working with faster timelines on the Lower Joseph project, in large part because of the amount of work that had been done in the area prior to the formation of the Collaborative. The jury is out on the East Face project, but participants acknowledged that the Purpose and Need that had been developed and endorsed by the Collaborative had been done within a year, even though substantial field work was required to document the state of the forest and frame the broad needs to restore the historical range of variation in the forest in the project area.

Ecological and social complexity - The group noted that the Collaborative is working on, and making limited progress, on several progressively more complex social and ecological issues in both the Lower Joseph and East Face projects. The fact that the East Face Purpose and Need statement specifically recognized the needed role the Collaborative provides to build and strengthen relationships amongst the stakeholders, to foster mutual learning, ensure collective input and access to knowledge of the members, and help develop understanding amongst them.

Trust - The social processes embedded in the Collaborative's activities have begun to build trust amongst the stakeholders. The increasingly frank statements of members' institutional positions on issues that are sensitive support this notion. Such declarations are seen as positive as they let everyone know what the issues are that will required negotiation. Thus far, such declarations have not precipitated outright conflicts.

The Collaborative has reached a point where concrete issues are being identified and alternative actions are being discussed in pursuit of compromise. Difficult, potentially conflicting issues are not avoided. Positions are stated clearly, even when they reflect strong differing views.

Given the candor and comfort of expressing positions at this stage, there is reason to believe that the Wallow-Whitman Forest Collaborative will play an important role in fostering reasoned stewardship and resource management that will secure the Forests for future generations; ensure that the multiple needs of the local residents as well as visitors are met.

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Exploring Opportunities and Challenges
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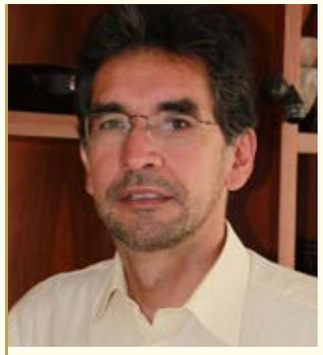
MYTHICAL DISTRIBUTION OF PLANTS, ANIMALS AND TRIBES IN THE COLOMBIAN AMAZON

Mr. Carlos Alberto Rodríguez
Mrs. Maria Clara van der Hammen



Mr. Carlos Alberto Rodríguez
Director of Tropenbos
International Colombia.

Mrs. Maria Clara van der Hammen
Consultant Tropenbos
International Colombia.

Email: tbicolombia@tropenboscol.com

Introduction

This text compiles some statements about the ancestral vision and management of the complex humid tropical forest ecosystem by indigenous communities living in the North West Amazon, an area that is considered not only because of its biodiversity but also in relation to the cultural diversity, one of the largest in the Amazon basin. More than 30 groups located in the Colombian part of this area, each with its own language, specific crops and shamanistic knowledge; share a number of cultural and ecological principals that make possible their coexistence (Map 1).

In the first place the shamanistic context of this territory, conceived as a huge roundhouse, will be presented. In the second place, the ecological and cultural principals that rule the relationship with nature will be mentioned. In the following section, the symbolic referents of the cultivated plants and the principals that rule the agricultural system and which have allowed the longstanding interaction with the tropical forest will be illustrated.

The content of this paper is based on inspired in publications like "The Management of the World" (Van der Hammen, 1992 and Rodriguez, Van der Hammen

and Gruezmacher, 2007), recent compilations by indigenous authors like "The life of the Chagra" (Andoque & Castro 2012), The cultural cartography of the Yucuna an Matapi (Uldarico Matapi y Rodrigo Yucuna 2012) and other unpublished documents prepared by indigenous authors. The intention of this paper is to highlight the traditional knowledge behind the management of the territory and the indigenous contribution to the conservation of the tropical forest as a complex ecosystem.

The Amazon Basin, the Large Maloca for All Indigenous People

Archeological studies establish that the Amazon region has been inhabited for nearly ten thousand years. Indigenous people explain the population of their territory through creation myths that refer to ancestral beings, in most cases related to animals. One of the most representative myths is the one of the ancestral anaconda, the big serpent that is used as a symbol of the Milky Way and of the Amazon River that flows 5,000 km across continent from the Andes to the Atlantic Ocean in Brazil meandering and displaying curves very similar to that of an anaconda.

According to the story, which is shared by many ethnic groups of the North West Amazon, the anaconda was flowing up as it transformed into a river and was carrying inside her different indigenous groups that were going to occupy each portion of the territory. Since the anaconda was packed with people, they had to find a place either in the head, the center or the tail. This was how the land was assigned: Each ethnic group will live in the part of the anaconda that they were transported in. The anaconda myth repeats itself in the different tributaries of the Amazon becoming thus a referent of spatial distribution in the North East Amazon.

From the perspective of shamanistic traditional knowledge, the way of understanding and managing the territory is by naming each river that is part of the basin starting from the mouth of the Amazon up to the river Japura-Caquetá, Apaporis, Miritíi. The sequence of names includes many geographical accidents such as beaches, rapids, backwaters and places with special vegetation. This shamanistic journey four large regions are defined which are the boundaries of knowledge and the recognition of other ethnic groups that share the large Amazon maloca. (Map 2) These four regions also define the cultural management regions and the importance of interethnic relationships in the territory. Many principles are shared and these may be understood as indigenous guidelines for the management of this region.

The Ecological-Cultural Principles

Indigenous people from the North East Amazon share principles related to the balance in the use of natural resources in the tropical humid forest. These principles are also known as the law of origin and they do not have an order of importance:

The creators defined a place of birth for each group and distributed the ancestral territory.

The mythical birthplaces of each ethnic group is located at the headwaters of small rivers like the Miriti River, and even of small creeks, In general terms the birth areas correspond to one original roundhouse and the descendants that occupied the surrounding or areas nearby always were connected by trails. The sons of the ancestors had the right to build their own roundhouses.

The shamans remember of at least 30 different ethnic groups that shared a macro territory, an area of more than five million hectares located between the Apaporis, the Miritíi and Caquetá Cahuinarí and Pamá Rivers. Traditional elders affirm that their great fathers remembered and named more than 150 different groups that used to exist in this area, Most of these groups disappeared as a result of intertribal conflicts, shamanistic confrontations and by "enchantment", which means that they transformed into plants or animals. The 32 groups that still exist in this macro territory are known by the specific territory to which they belong, there particular languages and certain shamanistic tasks (Map 3).

The creators assigned to each group a series of resources for the well-being.

The maloca is the center of interaction between human beings and nature, and the center of interaction among ethnic groups.

The shaman is in charge of keeping the balance of the relationships with nature.

Associated to these principles we find others that may be considered norms or rules that require a strict observance:

All the resources in nature have a spiritual owner and may not be used without their permission.

The shamans enter into contact with these spiritual owners in order to obtain permission for the use of the natural resources. By this way, abuse or overexploitation is avoided. The spiritual owners of the aquatic universe are associated with the large ananconda (Eunectes murinus) and are located along the rivers, creeks and lakes, and those related to the terrestrial world of plants and animals are associated with the jaguar (Phantera onca) and dominate specific places in the forest like

saltlicks where the soil accumulate minerals necessary for the physiology of many animals as the tapir. (Map 4).

Each spiritual owner takes care of a specific place and the creatures that live there, like the hundreds of fish species in case of the aquatic owners, or the many species of plants that exist in even one hectare of the amazon forest.

The shamans name each of these places and owners and recite the species that belong to them in spells that can take several minutes, and even hours, during nocturnal sessions of great concentration and that are oriented towards the identification of imbalances in the flow of vital energy through the whole system or universe.

The abuse in the use of resources will provoke a reaction of the spiritual owner that will send punishment in form of diseases.

The vital energy of nature most flow among all beings and should not accumulate in one person.

Each group has to carry out some ritual tasks to take care of the world and secure harmony.

These principles rule the relationship between human beings and nature: thus nature is humanized and human beings are considered nature. This is something that will be developed in the next section about indigenous agricultural systems.

The agricultural plots: cultivated men and women

The distribution of groups in the ancestral territory shows the strict occupation order, something that can also be seen in the agricultural systems. The chagra is a reflection of a sophisticated interaction with the tropical forest since plots are used only for a short period of time allowing the recovery of the forest in the long term. Therefore, it is a system that secures the regeneration of the vegetation coverage without generating an impact in the Amazon tropical forest ecosystem.

The nomad agriculture of the Amazon people is known as slash and burnt agriculture, the practices they have reflects a very detailed knowledge of tropical ecology. Indigenous agricultural systems are based in a thorough knowledge of the soils, of the physical characteristics like color, structure, fertility and geographical location in the landscape; very similar to the related scientific knowledge (Figure 1). There is also a close relationship between the soil and the type of vegetation, which is at the end an indicator of the quality of the land.

A fundamental aspect in indigenous agriculture is the ancestral assignation of seeds: each ethnic group has received a set of seeds that together constitute a large

variety of cultivated plants. Some ethnic groups have registered up to 100 varieties of cultivated plants and this is known as agro-biodiversity. (Figure 2)

With the ancestral assignation of cultivated plants by part of the creators came also the management rules that may be understood as the humanization of plants or the consideration of plants as people. Cultivated plants may be men or women and they have kinship relationships. For instance, tubers are women since they grow under earth, but one of them, the bore (Araceae), has a male attribute and may be considered as the father of cassava (Manihot sculenta). The distribution of tubers in the agricultural plot is explained by the myth of Canumá, an ancestral man that has been forbidden to visit the chagra by his wife but that once came up to spy on the women that were sowing seed in a circle. When women noticed his presence they started to run in all directions and ended up sowed in the borders of the chagra and transforming themselves into varieties of cassava.

The myth also narrated how Canumá himself ended up sowed in the center of the chagra becoming the coca (Eritroxylum coca). Since then this plant is considered as masculine and when it is cultivated they place the seeds representing the body of Canumá: his open legs, his wide open arms, many lines of plants are his trunk and others form his head. This lineal distribution is typical in masculine plants such like the pineapple (Ananas comosus) and the cultivated grape bush (pourouma cecropifolia), this latter produces a large fruit very similar to our grapes and very large leaves similar to those of the yarumo (ceeropia sp) which is another plant used to reduce acidity in the preparation of the coca chewing powder.

The distribution of plants in the chagra follow symbolic patterns that, in addition to the female and male referents, determines the place in the plot each plant should have: in the center, at the border, in the front or at the back (Figure 3). The chagra itself is understood as a body and it has a front part and a back; it is also orientated from the East to the West so there are westerly and easterly plants. (Figure 4) All this gives the chagra a status of sacred garden with a lot of symbolic contents that allow an understanding of relationships in families and relationships among ethnic groups in this territory.

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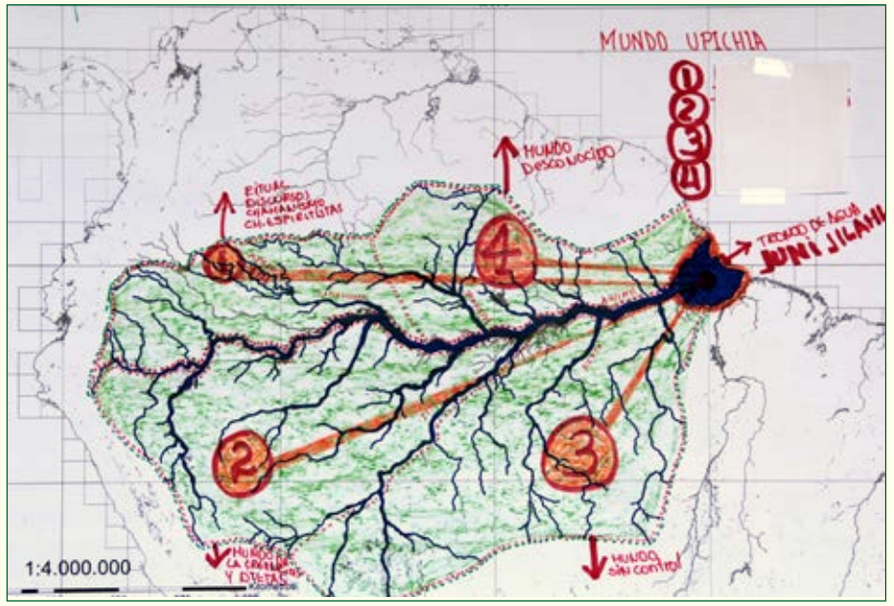
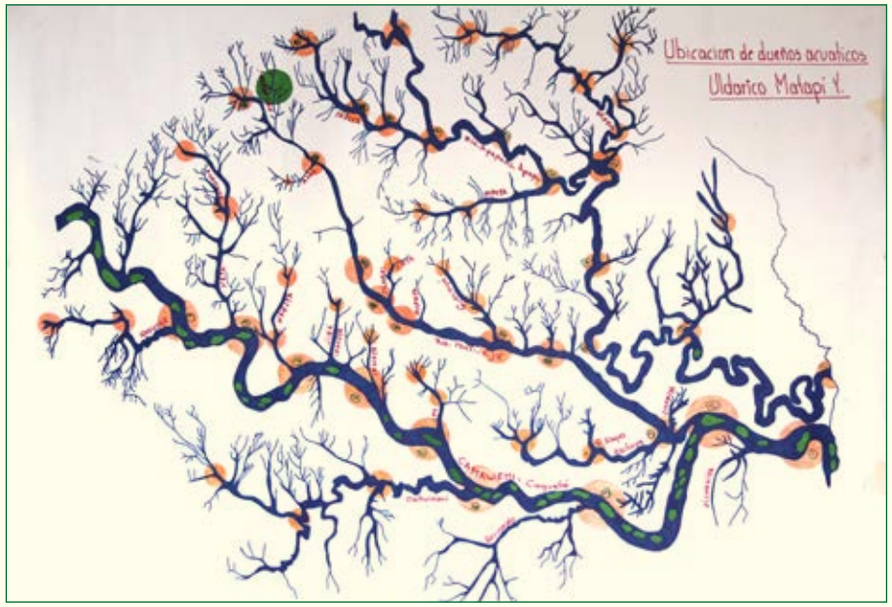
Map 1: Location of the study area (North West Amazon) in the Amazon Basin



Map 2: From the point of view of the yucuna and matapi shamans, the amazon basin is considered as a big roundhouse, divided into four main cultural areas inhabited by different ethnic groups. Illustration by Uldarico Matapi.

Map 3. Distribution of ethnic groups that share the same macro territory. Illustration by Rodrigo Yucuna.



Map 4: Location of the main aquatic spiritual owners along the Caquetá (Yapurá) Miriti and Apaporis rivers. The size of the circles indicates the importance of each spiritual owner. Illustration by Uldarico Matapi.

Map 5: : Distribution of the terrestrial spiritual owners in the macro territory. The size of the spots indicate the importance of the owners. Illustration by Uldarico Matapi.

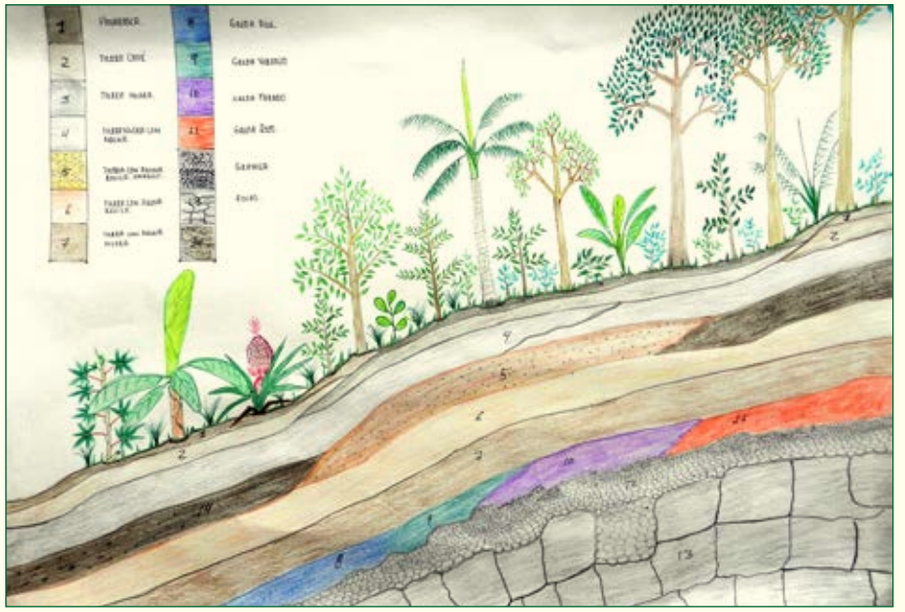


Figure 1: Traditional knowledge of soils in relation to cultivated plants. Each color indicate certain soil types and layers. Illustration by Hernando Castro.

Figure 2: Some examples of the huge agro-biodiversity in traditional plots, illustration by Abel Rodriguez

Figure 3: Distribution of cultivated plants in a traditional plot, which shows a symbolic order in an apparent chaos. Illustration by Abel Rodriguez

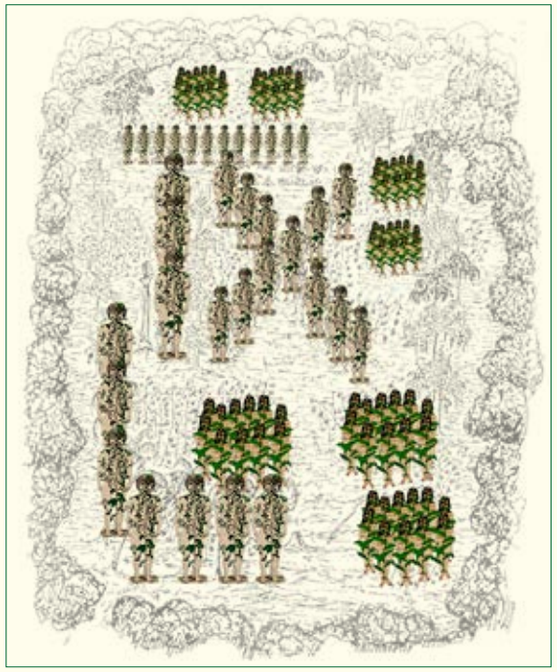


Figure 4: Distribution of cultivated plants in a traditional plot, which shows a symbolic order in an apparent chaos. Illustration by Abel Rodriguez

THE SECOND INTERNATIONAL FORUM
OF THE QUR'ANIC BOTANIC GARDEN
ISLAMIC PERSPECTIVES ON ECOSYSTEM MANAGEMENT

Sustainable Management of
the Botanic Gardens

ROLE OF BOTANIC GARDENS IN THE CONSERVATION OF PLANTS OF HISTORICAL AND CULTURAL IMPORTANCE

Dr Shahina A Ghazanfar

Dr Shahina A Ghazanfar
Head of Temperate Regional Team
Associate Editor, Edinburgh Journal of Botany
Royal Botanic Gardens Kew, UK
Email: s.ghazanfar@kew.org

Abstract

Global climate change, population growth and development have had a major impact on natural environments such that many plant species can no longer survive in their indigenous areas of distribution. Loss of a species means that there is also a loss of history and culture that is associated with it in its native environment. It is true that plants can be cultivated elsewhere and saved from extinction, but the cultural history which a plant carries with it in its native habitat cannot be carried on through cultivation in another region.

Botanic Gardens can play an important role in not only the cultivation and exhibition of plants from different regions, but also in the preservation of their associated cultural history. Early Botanic Gardens were physic gardens, and through cultivation and proper documentation were paramount in preserving the history of uses of many plant species. Several Botanic Gardens play a similar role today. They conserve and exhibit plants and, through proper research and documentation, help in preserving their cultural history.

Plants mentioned in the Qur'an are significant not only in that they are useful to everyday life, but because they have a historical, cultural and religious connotation. Botanic Gardens can contribute significantly in their conservation and cultivation, and through education increase our knowledge of the value of these plants in all respects.

Key words. Botanic Gardens, conservation, cultural plants, historical plants, Qur'anic plants.

Introduction

ORIGIN OF GARDENS

The earliest garden known is the Royal Garden of Thotmes in Egypt (circa 3000 BP), believed to have been planned by Nekht, the head gardener of the gardens attached to the Temple of Karnak (Fig. 1). This Royal Garden was rectangular in outline and had rows of date and branched doum palms, vine pergolas and lotus tanks. It is believed to have been used as a pleasure garden by the Royals (Houston 2007).

Fig. 1. The Royal Garden of Thotmes in Egypt. Source Wikipedia.

Another early Royal Garden was Sennacherib's Palace Garden in Nineveh, Iraq with was established and functioned during 705 and 681 BC. It was a Garden with exotic trees and shrubs and a sophisticated watering system, which pulled water from the river up to the aqueduct via an "Archimedes screw". This Garden is believed to be the legendry "Hanging Gardens of Babylon" (Dalley 2013), Figs 2, 3, 4.

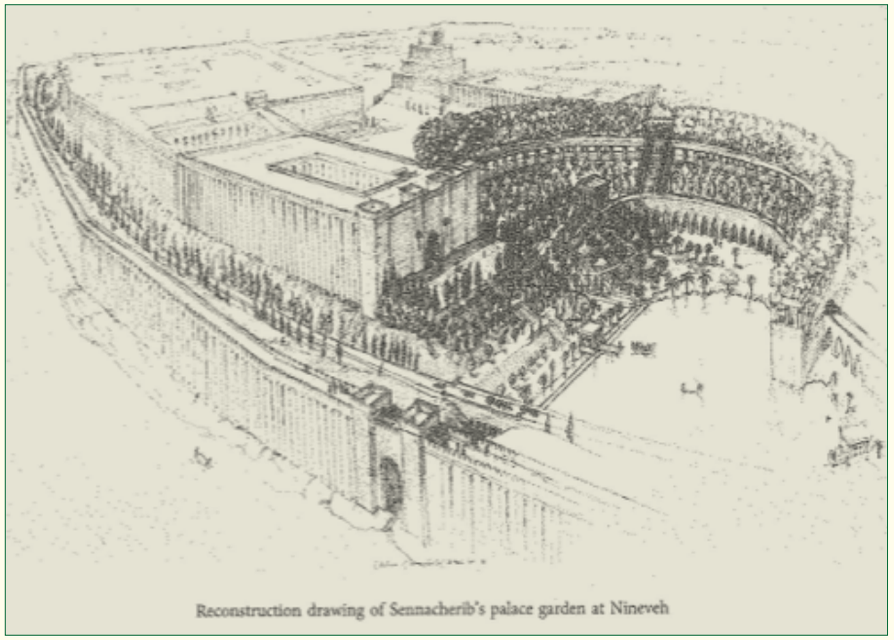


Fig. 2. Reconstruction drawing of Sennacherib's Palace Garden at Nineveh.

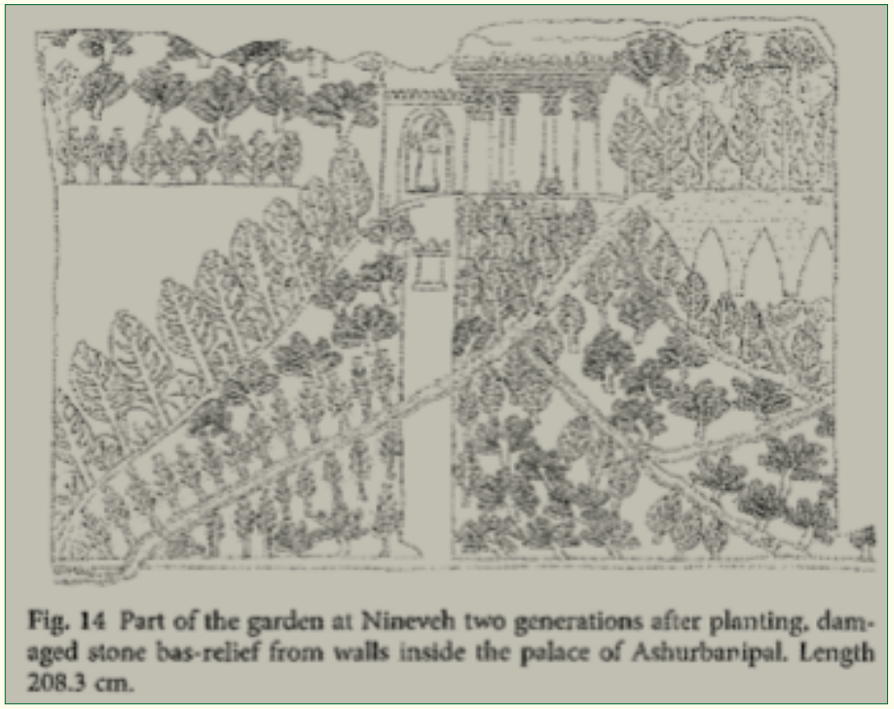


Fig. 3. (right) Part of the garden at Nineveh two generations after planting, damaged stone bas-relief walls inside the palace of Ashurbanipal (Fig. 14, from Dalley 2013).

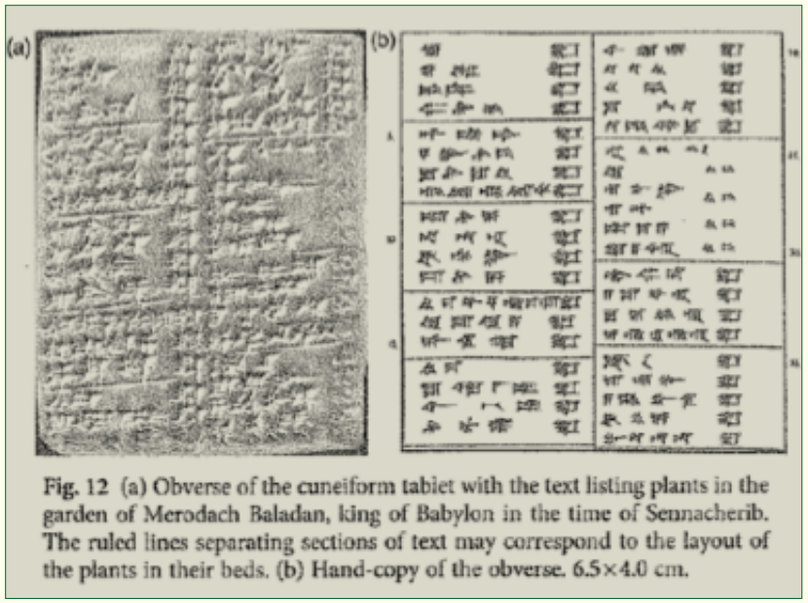


Fig. 12 (a) Obverse of the cuneiform tablet with the text listing plants in the garden of Merodach Baladan, king of Babylon in the time of Sennacherib. The ruled lines separating sections of text may correspond to the layout of the plants in their beds. (b) Hand-copy of the obverse. 6.5×4.0 cm.

Fig. 4. (left) Obverse of the cuneiform tablet with the text listing plants in the garden of Merodach Baladan in the time of Sennacherib. The ruled lines separating sections of text may correspond to the layout of the plants in their beds (Fig. 12 (a) & (b), from Dalley 2013).

The earliest botanic garden can perhaps be attributed to the Greeks. Early Greeks described plants but did not cultivate, the only record of the existence of anything of the nature of a botanic garden is the mention of Aristotle's Garden at Athens which he left to Theophrastus (370–287 BC). Theophrastus equipped and improved the garden and based his De historia plantarum on this garden listing 500 plants (Fig. 5).

Fig. 5. Frontispiece of the illustrated 1644 edition of the Enquiry into Plants (Historia Plantarum)

Source: Wikipedia.

The real founders of botanic gardens were the Chinese. Collectors were despatched to distant parts of the world, and the plants brought back and cultivated. Most of the plants were for their economic or medicinal value.

The Han Emperor, Wu Ti (140-86 BC) planted a number of rare herbaceous plants and trees brought from the southern regions of China in the garden of his palace. Plants, Nephelium litchi, N. logan, Areca catechu, banana, Quisqualis indica, Canarium album, C. pimela, Cinnamomum, Canna indica, and sweet oranges have been identified from a list of cultivated plants in his Garden (Hill 1990).

The Old Silk Road was instrumental in all trade to and from China, and ancient Chinese authors ascribe to Wu Ti, the introduction of the vine, pomegranate, safflower, common bean, cucumber, Lucerne, coriander, walnut to China.

Fig. 6. Sketch map of the Old Silk Road.

Gardens for agricultural crops

Several gardens in 10th C Andalusia (Spain) may be considered as precursors of botanic gardens in Europe. There is documentation on the Rusafa garden in Cordoba, which is one of the precursors of the botanic gardens of the European Renaissance (Ruiz 2007).

It was built in the 8th century by the Umayyad Emir Abdurrahman. In 11th-century Toledo, the al-Munyat al-Mansura ("Victory Garden") was built alongside the Tagus river and in Seville, the Almohad Caliph Abu Ya´qub Yusuf had the Buhayra garden built.

During the Al-Andalús period in Spain, many agronomists carried out experiments in these gardens and wrote treatises on agriculture, some of which were subsequently translated into Latin and studied in European universities up to the 17th century (Fig. 7).

Amongst these experts were Ibn al-Abbas al-Zahrawi (10th–11th century), Ibn Bassal and Ibn Wafid (11th century in Toledo), al-Tignari (11th-12th century in Granada), Abul-Jayr (11th century in Seville), Ibn al-Awwam (12th-13th century, also in Seville) and Ibn Luyun (14th century in Almeria).

Fig. 7. Flax, Linum usitatissimum, used in the production of linen, twine, rope and paper, as well as linseed oil (Franz Eugen Köhler, Köhler's Medizinal-Pflanzen, 1897).

Botanic Gardens

Historically, Botanic Gardens have developed from physic or agricultural gardens to gardens as showcase for horticultural ability and amenity.

During the 19th and 20th centuries botanic gardens were transformed from just collections of exotic plants to institutes of education and played an important role in ex situ preservation and conservation of plants.

Through their collections of living plants and plant made objects, botanic gardens also preserved history and culture.

Early Botanic Gardens were Physic Gardens, and through cultivation and proper documentation were paramount in preserving the history of uses of many plant species.

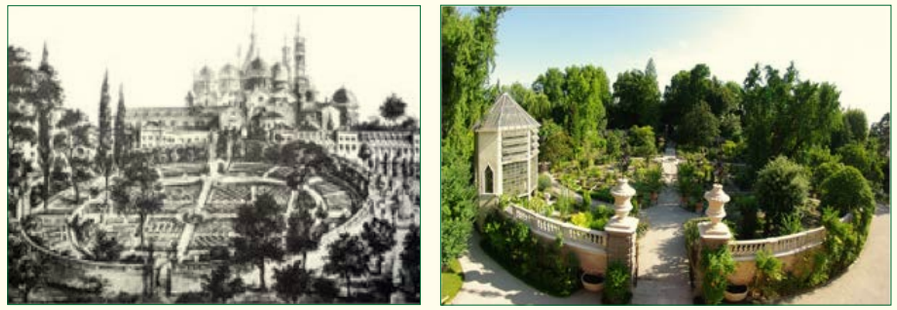


Fig. 8. Orto Botanic Garden in Padua, Italy. Source Wikipedia.
The Orto Botanico di Padova, a botanical garden in Padua, Italy was founded in 1545, and is the world's oldest academic botanical garden that is still in its original location (Fig. 8). As a botanic garden attached to an academic institution, it represents scientific exchanges, and understanding of the relationship between nature and culture. It has made a profound contribution to the development of many modern scientific disciplines, notably botany, medicine, chemistry, ecology, and pharmacy (Hill 1990).

Several Botanic Gardens today, conserve and exhibit plants and, through proper research and documentation, help in preserving plants cultural history.

Included amongst these in England is the Chelsea Physic Garden, founded in 1673. It started as the Apothecaries' Garden, with the purpose of training apprentices in identifying plants. Today, it functions as a physic garden and retains many of its original features. It includes a garden of medicinal plants; a pharmaceutical garden; a garden of world medicine and a garden of edible and useful plants and maintains a catalogue of plants and their source of origin (Minter 2000).

The University of Oxford Botanic Garden is the oldest botanic garden in Great Britain and one of the oldest scientific gardens in the world. The garden was founded in 1621 as a physic garden growing plants for medicinal research. Today it contains over 8,000 different plant species on 1.8 hectares (4½ acres).

It is one of the most diverse yet compact collections of plants in the world and includes representatives from over 90% of the higher plant families.

The Royal Botanic Gardens Kew was founded in 1759 by Princess Augusta, wife of Frederick (Prince of Wales) mother of King George III. The Royal Garden was united with Richmond estates to form one garden in 1802 with Joseph Banks its first Director; subsequent fame of the Gardens was largely due to him. In 1841 Royal Botanic Gardens Kew became a public botanic garden with William J. Hooker as its first director.

Fig. 9. Royal Botanic Gardens Kew, Elizabeth Gate.

Under his direction the gardens expanded; an arboretum of 270 acres (1.1 km2) was created and many new glass-houses were erected. A museum of economic botany was established to house plant made objects which were collected from all over the world (Desmond 2007)

With the establishment of a herbarium and a growing collection of both herbarium and living plants, Kew developed into a leading botanic garden and a scientific institute. Major Floras such as The Flora of British India, Flora Capensis, Flora of Topical Africa, were started which preserved the history, distribution and economic uses of plants.

Examples of historical introductions include the Maidenhair tree (Gingko biloba), planted at Kew in 1762, less than 40 years after the first specimens had been introduced to Europe from China.

Fig. 10. Leaves of Gingko biloba.

Conservation

Botanic gardens play a very important role in conserving and preserving rare, endemic and threatened plants. One such example is the rare pygmy Rwandan water lily, which was saved from extinction by botanists from Kew Gardens. Nymphaea thermarum is the world's smallest water lily found in East Africa. All wild plants were lost due to destruction of its native habitat, but it was saved from extinction when it was grown from seed at the Royal Botanic Gardens Kew in 2009.

Fig. 11. Nymphaea thermarum. Photo © Kew.

Preserving history and culture through plants in botanic gardens

Several plants are mentioned in the Qur'an and Hadith that have a history of use as food, medicine or have value for a particular characteristic they hold.

Some twenty plants are mentioned in the Qur'an and some fifty four plants in the Hadith. Most of the plants in the Qur'an can be identified to present day plants by the mention of their Arabic name in the Qur'an.

A couple, however, are difficult to name with certainty, and suggestions to their identity have been put forward with regard to the context in which these have been mentioned.

Plants mentioned in the Qur'an are significant not only in that they are useful to everyday life, but because they have a historical, cultural and religious connotation. The very mention of some plants in the Qur'an signifies their importance

and relevance as they are known either for their use (such as olive, grape, fig) or for reference to their character or what they might denote (such as tamarisk).

Through global climate change and human impact on environment, the natural habitats of many plant communities and animals are being lost or have changed, with the result that many species can no longer survive in their native areas of distribution.

A loss of a species means that there is also a loss of history and culture that is associated with it in its native environment.

It is true that plants can be cultivated and saved from extinction, but the cultural history which a plant carries with it in its native habitat cannot be carried on through cultivation unless done so in a garden which recognises and preserves its cultural significance and history, and as well its scientific value.

Examples of plants mentioned in the Qur'an that can be cultivated in such Botanic Gardens include Alhagi maurorm. This species is used in folk medicine as a treatment for glandular tumors, nasal polyps, and the treatment of problems of the bile duct. It is also used as a medicinal herb for abdominal problems, as a diuretic, laxative, and in the treatment of rheumatism and hemorrhoids (Ghazanfar 1994). It has also been used as a sweetener. This plant is assessed as Vulnerable (under the IUCN Categories) in parts of the Arabian Peninsula due to habitat loss. Botanic Gardens can cultivate and help preserve its cultural value and can educate the public and disseminate information so that species such as Alhagi maurorm would be conserved in their natural habitats.

Another example is that of Salvadora persica, the tooth brush tree, a popular chewing stick throughout the Arabian Peninsula, as well as the wider Muslim world (Ghazanfar 1994). Cultivation of this common plant in a Botanic Garden can bring out its cultural importance to the public and as well preserve it.

Fig. 12. Salvadora persica. Photo: © S.A. Ghazanfar.

Another good example is pomegrante, Punica granatum mentioned in the Qur'an that we all know as a fruit, but few of are aware of its cultural and religious importance and histroy.

Here I give an example of this fruit and the fascinating history it bears.

In them will be fruits, and dates and pomegranates - Sura 55: Verse 68

Punica is a genus with two species, Punica granatum native to Iran, Afghanistan and SW Pakistan, and Punica protopunica endemic to Socotra. Pomegranate is cultivated in most warm temperate countries for its fruit as an ornamental plant (Ghazanfar 1994). It is naturalized in a few habitats in Asia, but is never reported to be invasive. It was reported to be common in Palestine and several villages and towns bore the name Rimmon (Lipschits et al. 2012).

The pomegranate has been known since ancient times in the Middle East and Egypt by several vernacular names. It was given a Latin name, Punica granatum, [derived from Punic, and granatum] by Carl Linneaus in 1753 [Species Plantarum 1: 472 (1753). The generic term, Punica, was the Roman name for Carthage from where the best pomegranates came to Italy.

There is no extant ancient name for the fruit in Persian. The Sanskrit name, dadima or dalima, Malayan- delima, and Indian, darim must have a root in some Iranian language. According to Laufer (1919) the word danak, or dana (small grain, grains) could be the foundation of the Iranian word for pomegranate, from where Sanskrit, danika (grians) is derived.

Through the Silk route, pomegranate came to China, and there is an extant ancient Chinese transcription dating back to 212 AD with the name riu, ru for the

fruit in some Iranian dialect. This lost Iranian word probably represents the foundation of the Greek word (origin not explained) and the Semetic, Hebrew names, rimmōn, Arabic, rummān, Amharic, rumāanāa, Syriac, rumonō, and from which the Egyptian name armani or arhmāni (Coptic, erman or herman) is derived.

The Persian name anar can be traced to the name used by Iranian colonies outside Iran proper –those of Sogdiana (modern day Uzbekistan and Tajikistan) and Turkistan, both of which played prominent roles in ancient Persia. The Sogdian word for pomegranate is written as n'r'kn [reads as narak (a)] which developed from anar-aka, the extant Persian word (anar) for pomegranate; this was also adopted by the Mongols, while the Uyghur have it as nara. Anar is used by several other languages including Azeri, Hindi, Kurdish, Turkish, and Urdu.

The Arabic name rumān can be traced to the Egyptian and Semitic name rmn, and the Hebrew rimmôn; this root was brought by Arabic to several languages including Portuguese (romã), and Kabyle, rrumman.

The English name pomegranate comes from the Latin pome [apple] and granate [from granatus]. (The weapon grenade was named by the French deriving the name from the fruit).

The pomegranate is one of the oldest fruits known to man. Excavations of sites of Early Bronze Age (3500–2000 BC) shows pomegranate as of the first cultivated fruits in SW Asia. It was brought to Egypt via Syria around 1600 BC during the rule of Hyksos, where it is believed to have been used medicinally and as a dye. Around 957 BC, Solomon's Temple was believed to have been decorated with pomegranates and the fruit was included in the Jewish priest's robes as described in the Torah (Exodus 28:33–34). In 700 BC, it was brought to Italy through Carthage, where it was initially cultivated [hence the name Punic – the Romans called it punicum malum, the Punic apple]. In ancient Persia it was a celebrated fruit with the Zoroastrians who considered it as a symbol of eternal life, and it was a symbol of strength in Persian culture. It was brought to China from the Middle East (together with other SW Asian fruits such as walnut, coriander, cucumber, basil) during the Han dynasty around 138–125 BC through the legendary Silk Road. The Moors took the pomegranate to Spain round 800 AD where the city of Granada was named after the pomegranate, and which also became their national emblem. Pomegranate is prominent in the mosaics of the Alhambra built in 1238–1358. The pomegranate came to Britain in the 16th C during the reign of King Henry VIII, when he celebrated his marriage to Catherine of Aragon, the daughter of Queen Isabella and King Ferdinand of Spain. The pomegranate reached Americas through the Spanish conquistadors during the 15th C.

The pomegranate has always been a celebrated fruit in many different cultures. It has been a symbol of fertility, prosperity, righteousness and eternal life especially by the Jewish and ancient Egyptians who put pomegranates in burials for rebirth. It was considered a fruit blessed by Gods and believingly used by Hittite, the Goddess of agriculture to bless her followers. It was a symbol of strength in ancient Persia, and the rich colour of its flowers and seeds have been used as a metaphor of female beauty (Firdausi: Shahnama); it has also been depicted in Moghul paintings as a tree of paradise. It is believed to have been recommended by Prophet Muhammad as a fruit that purged the body and spirit of jealousy and hate (As Sayuti, ed. 1994; Ibn Qayyim Al Jawziya, translated by Penelope Johnston 1998).

Medicinally, pomegranate has been used as a health tonic, its rind as a vermifuge, and the juice as an antiseptic. It is rich in vitamin C and folic acid. The tanniferous rind has been used for tanning leather and the flowers yield a red dye. Grenadine syrup obtained from it is highly regarded for its taste as a drink and in cuisine, and recently popularized as an antioxidant and health drink.

References to the pomegranate in the verses of the Qur'an refer to it as a blessing, as a symbol of paradise and as an example of not to be excessive and wasteful.

References in the Qur'an: Sura 6 (An 'am – Cattle) Verse 99, 141; Sura 55 (Rahman – (God) Most Gracious) Verse 68].

Fig. 13. Pomegranate. From: Fruits of warm climates, J. Morton (1987).

Summary

Botanic Gardens can play a very significant role in the conservation and preservation of plants that are of religious, cultural and historical importance. Through the cultivation and research of such plants, Botanic Gardens can be true scientific institutions of importance to international communities. From the early Botanic Gardens that were physic gardens, Botanic Gardens have evolved as scientific institutes that can help in conservation and education. Plants mentioned in the Qur'an are significant not only in that they are useful to everyday life, but because they have a historical, cultural and religious connotation. Botanic Gardens can contribute significantly in their conservation and cultivation, and through education increase our knowledge of the value of these plants in all respects.

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CONTEMPORARY CHALLENGES FOR BOTANIC GARDENS IN EDUCATION, ENVIRONMENTAL AWARENESS-BUILDING, AND PLANT CONSERVATION ACTION

Dr Peter Wyse Jackson

Dr Peter Wyse Jackson
President, Missouri Botanical Garden and George Engelmann Professor of Botany, Washington University at St Louis
Chairman, Global Partnership for Plant Conservation - Chairman, World Flora Online Consortium
PO Box 299 St Louis, Missouri 63166 USA
Email: peter.wysejackson@mobot.org

Botanic Gardens and the Decade on Biodiversity

In 2010 the United Nations designated this current period as the 'Decade on Biodiversity', with the aim of halting the loss of biodiversity by 2020. With approximately a quarter of all vascular plants species currently in danger of extinction in the wild, some 100,000 plant species, the urgency of safeguarding them is now becoming well known. This crisis for plants has had a transformative impact on the world's botanic gardens. This paper outlines the development of new roles for botanic gardens worldwide, as well as highlighting the ways in which gardens throughout the world can and are responding to the challenges to become leaders in biodiversity conservation and environmental education.

Over the last few decades, botanic gardens throughout the world have undergone a renaissance and a remarkable transformation. In the early 1980s there were about 800 botanic gardens known worldwide (fig. 1). By 1990 that number had grown to 1,400 and today there are more than 3,000 known to exist. The most up to date list of botanic gardens worldwide is available from Botanic Gardens Conservation International (www.bgci.org) which maintains an online searchable database, the GardenSearch. As the greatest repositories of living plant collections worldwide, their importance and roles are so much better understood and appreciated by increasingly wide audiences. Many botanic gardens have also been reinvigorated and rejuvenated to undertake a wide range of new tasks, particularly in environmental awareness, education and plant conservation.

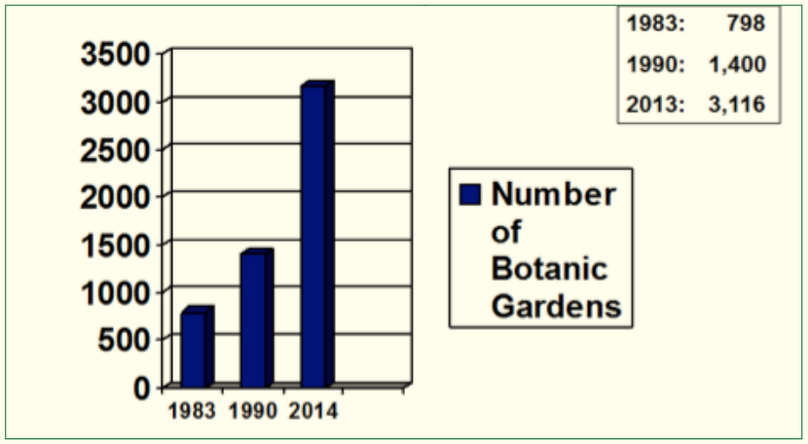

Figure 1. Development in the number of botanic gardens worldwide over the last 30 years.

It is worth considering what have been the drivers for change in botanic gardens, and in particular what has stimulated the development of new botanic gardens in so many parts of the world. Clearly the increasing environmental awareness and understanding of the importance of biodiversity and the threats it faces has encouraged the creation of hundreds of new botanic gardens, in most parts of the world. The greatest number of botanic gardens is in Europe and North America, but over the last few decades, large numbers of new institutions have been created in East and South Asia, most notably in China, as well as in Central and South America (figure 2). Ironically, in the past the greatest numbers of botanic gardens generally occurred in countries with the smallest diversity of native plants. The majority of botanic gardens were in the temperate regions, whereas tropical countries such as Mexico, Brazil, Indonesia and Colombia had few botanic gardens and are often termed 'mega-diverse' in terms of the vast number of native plants for which they provide a home.

The Middle Eastern region of the world still has a relatively small number of botanic gardens (28), although notable new gardens and botanic garden projects are now underway in countries including Qatar, Jordan, Saudi Arabia, Kuwait and Oman. In Qatar the important project being undertaken by the Qatar Foundation, to develop the Qur'anic Botanic Garden, is a regional initiative of great significance for future public awareness of plants and their conservation needs, and to highlight the important cultural, heritage and religious connections between people and nature. The mission of the Qur'anic Botanic Garden is to promote knowledge of the plants, botanical terms, and conservation principles mentioned in the Holy Qur'an and Sunnah (http://www.qf.org.qa/explore/heritage-centers/quranic-botanic-garden/quranic-botanic-garden).

Region	*Number of botanic gardens*
Africa and the Indian Ocean	157
East and South and South-west Asia	432[a]
Australasia	164[b]
Caribbean Islands	54
Central America	117[c]
Europe	823[d]
Former Soviet Union	193[e]
Middle East	28
North America	836[f]
South America	173
Southeast Asia	49
Total	3026

[a]Excludes South-East Asia.
[b]Includes the southern pacific islands and Papua New Guinea.
[c]Includes Mexico.
[d]Includes the Baltic countries that were part of the former Soviet Union (but not Belarus, the Russian Federation and Ukraine) and Greenland.
[e]Excludes Estonia, Latvia and Lithuania.
[f]Canada and the USA only.

Figure 2: the worldwide distribution of botanic gardens (from Wyse Jackson and Sutherland, 2013).

In 2000, Botanic Gardens Conservation International (BGCI) launched an initiative that led to the development and adoption of a new global programme for the conservation of plant diversity worldwide – the Global Strategy for Plant Conservation. The history of this initiative can be summarized as follows and is documented fully in Wyse Jackson (2002). At the XVI International Botanical Congress held in St Louis, Missouri in August 1999 a resolution was passed urging the world community to recognise plant conservation as an outstanding global priority. Responding to this resolution, BGCI organised a meeting in April, 2000 in Las Palmas de Gran Canaria, Spain to consider the need for a new global initiative in support of plant conservation. The results were published by BGCI as 'The Gran Canaria Declaration' in which the group resolved that a Global Strategy for Plant Conservation and an associated programme for its implementation should be developed urgently, within the framework of the CBD (Blackmore et al., 2001). The aim of this programme was to halt the current and continuing unacceptable loss of plant diversity by supporting and facilitating appropriate plant conservation initiatives at all levels. The Declaration was then submitted to the 5th Meeting of the Conference of the Parties to the Convention on Biological Diversity (COP5), held in Nairobi, Kenya 15-26th May, 2000.

Over a series of conferences of the Convention on Biological Diversity, it was agreed that there was a need for the development of a special strategy for plant conservation, due to the fundamental importance of plants as the basis of most ecosystems, the services and products they provide and the current crisis in the loss of plants worldwide. It was further agreed that the elements of a strategy outlined in the Gran Canaria Declaration provided a useful basis on which to determine the scope of the strategy. These elements included:

- Integrated in situ and ex situ conservation
- Research, monitoring and management of information
- Social and economic benefit of plant diversity
- Education and public awareness
- Capacity building

On 19th April, 2002, the 6th CBD COP adopted the Global Strategy for Plant Conservation. Its development and adoption had been the result of a unique partnership of international and national organizations, governments and NGOs. The Strategy provided the first ever globally agreed framework for actions related to plant conservation at global, regional, national and local levels. The Strategy was also backed by a wide range of organisations and institutions – governments, intergovernmental organizations, United Nations agencies, conservation and research organizations such as protected-area management boards, botanic gardens, gene banks, universities, research institutes, non-governmental organizations and networks of non-governmental organizations, and the private sector. The inclusion of 16 outcome-orientated, targets, aimed at achieving a series of measurable goals by 2010 was particularly innovative. This was the first time that the CBD has incorporated such targets into its operations, which subsequently became a model and the norm for future work on other aspects of the work of the Convention.

Following the adoption of the GSPC, A Global Partnership for Plant Conservation (GPPC) was launched in 2004, building on a base of organisations that were active in the original "Gran Canaria Group". The GPPC was subsequently recognised by the CBD as forming a component of a flexible coordination mechanism for the Strategy. It now includes about 50 members, all with significant international programmes in plant conservation that supports national GSPC implementation (see: www.plants2020.net). At the same time the CBD requested countries to nominate national GSPC focal points, and to date over 70 such focal points have been established. These focal points help coordinate national responses to the GSPC and play a role in reporting progress back to the CBD

on GSPC progress. Botanic gardens in several countries have become the GSPC national focal points.

In November 2010, the United Nations Convention on Biological Diversity adopted a consolidated and updated Global Strategy for Plant Conservation (GSPC) that incorporates revised targets for 2020. The first phase of the GSPC was implemented from 2002 until 2010. The GSPC had a fundamentally important impact on the priorities and roles for botanic gardens worldwide, providing a coherent series of objectives that could be adopted and incorporated into their individual programmes and activities. This included the development of more comprehensive programmes in ex situ conservation; new emphasis given to ecological restoration, as well as conservation biology research, capacity building and education for plant conservation.

The establishment of the GSPC in 2002 through the CBD represented an important milestone for the world's botanic gardens. Not only did it provide a valuable strategic framework for their collective and individual actions in plant conservation but it also highlighted to the international community their fundamental importance for the conservation and management of biodiversity. Never before had botanic gardens been so specifically acknowledged for their actual and potential contributions. Since 2002 botanic gardens throughout the world have reacted with enthusiasm and determination to rise to the challenge and responsibility of helping to achieve the GSPC objectives. With the renewal of the GSPC in 2010 (when a consolidated update of the GSPC was adopted by the CBD), for the period 2011-2020, botanic gardens face heightened responsibilities, in particular considering the GSPC's stated objective to halt the loss of plant diversity by 2020.

The ultimate and long-term objective of the Global Strategy for Plant Conservation is to halt the current and continuing loss of plant diversity. The strategy provides a framework to facilitate harmony between existing initiatives aimed at plant conservation, to identify gaps where new initiatives are required, and to promote mobilization of the necessary resources. It also provides a tool to enhance ecosystem conservation and the sustainable use of biodiversity and to focus on the vital role of plants in the structure and functioning of ecological systems and assure the continued and future provision of the goods and services such systems provide. The scope of the strategy is:

- Understanding, documenting and recognizing plant diversity
- Conserving plant diversity
- Using plant diversity sustainably
- Promoting education and awareness about plant diversity
- Capacity building for plant diversity

Over the twelve years following the adoption of the GSPC, botanic gardens have played a leading role in its implementation. Such work has been documented in relation to each of the sixteen targets in a Plant Conservation Report: A review of progress in implementing the Global Strategy for Plant Conservation (GSPC) prepared by the CBD Secretariat and the Global Partnership for Plant Conservation (GPPC) in 2009 (CBD Secretariat and the Global Partnership for Plant Conservation, 2009). A Technical Report in support of the mid-term review of the GSPC in 2014 has been compiled by the Global Partnership for Plant Conservation (GPPC) in association with the Secretariat of the CBD and BGCI and included in http://www.cbd.int/gbo/gbo4/GSPC-draft-tech-doc-en.pdf In late 2014 a new Plant Conservation Report was published too by Botanic Gardens Conservation International and the CBD Secretariat (Sharrock et al., 2014) (http://www.bgci.org/files/Worldwide/News/2014/September_Oct/plantweb.pdf).

What have been the main drivers of botanic garden development?

- New botanic gardens have been needed to address environmental issues (education & biodiversity conservation);
- Conversion of existing gardens to become 'botanic' for various reasons;
- Recognition that botanic gardens are key assets for all countries and most major cities;
- Establishment of local botanic gardens to support variety of community needs.

The changing roles of botanic gardens since the 1980s

It is worth reviewing the changing roles of botanic gardens since the 1980s. During much of the 20th century, botanic gardens remained important institutions active in managing extensive and diverse collections of living plants and dried herbarium plant specimens. At the risk of over-generalising, we can say that up to the 1980s their particular focus was on:

1. Science and research, particularly in taxonomy

The world's major botanic gardens and many university botanic gardens maintain (or are associated with) extensive herbaria and so were, and remain today, ideally suited to undertake research in plant taxonomy.

2. Living collections management

3. Public amenity, relaxation and recreation

Most botanic gardens had limited public educational activities and few botanic gardens actually employed dedicated professional educational staff. Educational activities were often related to providing guided tours of the garden or explaining the identities, uses, names and origins of individual plants. Little education work was focused on raising public awareness of environmental issues or plant conservation needs.

4. Primarily cultivation of exotic plants

Botanic gardens typically maintained diverse eclectic collections of exotic plants assembled from around the world, often obtained through seed exchange.

The contemporary roles of botanic gardens

Today we can recognise that there has been a remarkable "reinvention" of botanic gardens over the last three decades, with their contemporary roles greatly expanded, refocused and deepened. Some of the key areas in which significant changes and development have taken place are highlighted below, illustrated with examples drawn from the work of the Missouri Botanical Garden.

1. Science and research

In science and research, botanic gardens continue to play important roles in taxonomy, genetics, conservation biology and a wide range of other disciplines. For example, many of the institutions involved in the development of a World Flora Online (WFO) by 2020 (representing Target 1 of the GSPC) are botanic gardens. For example, the Missouri Botanical Garden has played a leadership role in and is a member of the World Flora Online (WFO) Consortium. Ongoing major Flora projects that are coordinated at the Missouri Botanical Garden include Flora Mesoamericana, Flora of North America, Flora of China and several national projects, all of which will contribute in a substantial way to the achievement of the WFO. The Garden's online openly-available database of plant diversity TROPICOS, has grown to become the world's largest botanical database. It now contains 1.25 million plant names, 4 million specimen records and a host of other data on collectors, authors, images and literature. The Garden's discoveries and activities in plant systematics result in significant numbers of new species being collected and described each year. For example, in 2012, the Garden's scientists described and named 131 new species. By the end of the 2012 the Garden's Herbarium had expanded to include 6.4 million specimens. The work of botanic gardens in exploration, taxonomy and floristics particularly of the world's vascular flora and bryophytes is of fundamental importance and an essential contribution to providing a comprehensive and coherent baseline of knowledge about plants that is often vitally important for other disciplines too, especially ecology, ecosystem manage-

ment and restoration and research in areas of direct economic importance such as agriculture, forestry, horticulture and healthcare.

Increased capacity in molecular research has allowed some botanic gardens to focus on the genetic diversity of their collections and the plants with which they work (mainly for conservation and phylogenetic research purposes). Over the coming years we can expect this work to expand even further as molecular techniques and their associated costs become cheaper and more commonplace.

Other notable areas of botanic gardens work in science and research include ethnobotany, climate change, plant pathology, bioinformatics, evolution, ecology and restoration ecology, horticulture, phenology, plant breeding. and plant population dynamics and diversity.

2. Living collections management, including seed and tissue storage

Botanic gardens today tend to implement very extensive computer-based systems to document their collections. Such systems can significantly enhance the value of plant collections for conservation and research purposes. Increasingly these systems are being made internet accessible, helping to ensure that visitors and other users can locate individual plants and information about these accessions even before they visit the Garden. The coordination of tasks and living collections between botanic gardens nationally, regionally and worldwide has become more effective too in recent years. These efforts have been led by Botanic Gardens Conservation International (BGCI), which, in the 1990s created an online searchable database of living collections in botanic gardens, the PlantSearch (www.bgci.org).

Priorities for coordinating collections, especially for conservation purposes, have been identified as:

- Make greater efforts to integrate ex situ conservation with in situ programmes focused on the restoration of species in the wild, by engaging with local and national conservation authorities;
- Record and share plant propagation protocols to support restoration and reintroduction programmes;
- Provide regular up-dates to BGCI's PlantSearch database;
- Ensure the highest standards of record keeping, cultivation, propagation, display and exchange for threatened species within their collections.
- Mechanisms to ensure prioritisation and coordination are needed.

BGCI's PlantSearch database now incorporates 1,278,743 collection records, representing 424,113 taxa, at 1,090 contributing institutions (www.bgci.org, data from 30th December 2014). Recent survey work by BGCI indicates that in Australia: 57% of the threatened plants of that country are now included in living

collections. In New Zealand the figure is 55%; in North America it is 39% and in Europe 42% (Sharrock and Jones, 2009). However, in some regions of high plant diversity there are still low percentages of threatened plants in cultivation.

Many botanic gardens have expanded their operations by the development of seed banks. For example, the Millennium Seed Bank, led by the Royal Botanic Gardens Kew in the U.K., has achieved remarkable results. The Millennium Seed Bank Partnership is now the largest ex situ plant conservation project in the world. Its focus is on global plant life faced with the threat of extinction and plants of most use for the future. The Millennium Seed Bank Partnership involves partners in 80 countries, which has already banked seed of 10% of the world's wild plant species. It aims to achieve a target of saving 25% of those species with bankable seeds by 2020 (nominally 75,000 species). In addition, in 2012 the Missouri Botanical Garden opened its own new regional seed bank. Its initial focus is on the storage and conservation of plant diversity of native (especially threatened) plant species of the species-rich Ozark region of the Mid-west of the U.S.A. To date 29 regional threatened species and 223 additional species are protected in this long-term ex situ seed storage facility.

3. Greater emphasis on planned collections (accession policies) & more natives grown

There has been a shift in botanic gardens from growing plants for no particular purpose, to the development of clear accession policies, where plants are grown to meet specific needs in research, education, conservation or public amenity purposes. This has also included a trend towards growing more native plants, as well as eliminating plant accessions that are known to be invasive. Botanic gardens have been very active in initiatives to create new invasive species guidelines, codes of conducts and assessment protocols to guide future acquisitions for the Garden's living collections and to guide the sharing of seeds between collaborating botanic gardens.

4. Cultivation for biodiversity conservation (ex situ and in situ)

Worldwide botanic gardens grow some 115,000 plant species (probably about one quarter of the plants of the world are included in their collections). Ex situ conservation has become a central focus for many, if not most, of the world's significant botanic gardens, which are increasingly developing conservation programmes to ensure the survival of important plant species from their own regions or from areas where they have a particular concern. Some priority categories for such ex situ conservation programmes are outlined below.

Priority categories for ex situ conservation programmes:

- Species or taxa that are in immediate danger of extinction, either locally, nationally or globally.
- Species or taxa that are of local economic importance, such as minor food crops, medicinal plants and wild or cultivated plants providing the basis of local industries, agriculture, horticulture and crafts.
- Species or taxa, such as local ecotypes, that may be required for specific reintroduction or habitat
- Local 'flagship' species or subspecies that will stimulate conservation awareness and can be incorporated into education and fund raising programmes.
- Species or taxa that are of special scientific interest, such as narrow endemics or geographical relics.
  (From: Wyse Jackson and Sutherland, 2000).
  To achieve a better focused approach to ex situ conservation botanic gardens are recommended to:
- Develop and implement their own institutional ex situ conservation programmes
- They should collaborate as part of coordinated network approach
- They should work to identify and fill gaps in coverage
- They should undertake research in conservation biology to understand conservation pressures and declines
- They should seek to integrate species conservation and ecological restoration
- They should strive to better understand and manage the basis of diversity at species and population level

Conservation needs of particular plant species and their habitats is therefore often now a driver for botanic garden activities and priorities. For example, the Missouri Botanical Garden is a participant in the U.S. Center for Plant Conservation (CPC) network of botanic gardens, and maintains collections of 35 endangered plants from the North American Central Highlands, as part of the CPC National Collection. This amounts to 25% of the critically imperilled and vulnerable plant species in this region. Management plans for all of these species have been developed, as well as models for restoration and recovery of several species. At the Garden's Shaw Nature Reserve a native plant garden with c.700 species is maintained. It is used to promote native plant conservation and their use in sustainable ornamental horticulture, as well as to study plant conservation, cultivation and management ex situ.

Related to in situ conservation, elsewhere in the world, the Garden's research team in Madagascar has carried out the identification and evaluation of the important

remaining sites for plant diversity in Madagascar. As a consequence of this, the Garden is implementing a major program in Madagascar to safeguard a series of key priority plant-rich areas. Protection is undertaken through the implementation of community-based partnerships between local people and the Garden. A wide range of stakeholder partners in Madagascar are also involved. In total, an area of over 150,000 acres (+60,000ha) is protected in this network of sites. The Garden has also led in the development of a series of management plans for three national parks (in total c.5 million acres / c.2 million ha) in Peru, Ecuador and Bolivia.

5. Environmental protection and promoting sustainability

Environmental protection and promoting sustainability have become a central focus for the missions of many botanic gardens. For example, at the Missouri Botanical Garden, in its home base of the city of St. Louis, the Garden launched (in 2013) a community-wide initiative, BiodiverseCity St. Louis, aimed at protecting, promoting, and planning for local biodiversity throughout the urban/suburban eco-region of St Louis. The Garden's recently completed Flora of Missouri project serves as a critically important, data-driven foundation to help promote sustainability and assess the current state of local flora, identify short- and long-term threats, and prioritize and pursue opportunities for protection and restoration.

The aim of many of the Garden's programmes is to achieve sustainable management of plant resources by local communities. Developing a trusted collaborative relationship between the Garden and local communities is essential if conservation objectives are to be achieved. In many cases effective conservation of threatened plants will only be possible if the sustainable use of wild harvested plant-based products can be attained, and this requires ensuring that conservation actions are fully integrated with community development programs and poverty alleviation measures. The Garden has implemented such community-based conservation programs in Bolivia, Peru and Madagascar.

A further project led by the Garden is the 'Sacred Seeds Program', which promotes and undertakes conservation and sustainable use of traditional food and medicinal species in over 30 garden networks on 5 continents. Another example is the Garden's activities in sustainable resource use education in Madagascar. This work is accompanied by ethnobotanical inventories (carried out by the Garden's Malagasy staff and students). Such work is supporting local populations of c.30-40,000 people and includes the identification of about a dozen native timber species, and native palms as well, which are subsequently grown in local nurseries to support local agro-forestry and 300-400 important medicinal plants identified, documented and conserved.

6. Major programmes in public education and environmental awareness

Botanic gardens have developed to become major centres for education and public awareness of plant conservation and the need for environmental protection and sustainability. Today they receive in excess of 250 million visitors each year. Since most botanic gardens are situated in areas of high population, often cities or suburban areas, they provide important resources and locations to ensure that local people, especially children, have opportunities to experience nature in a safe and structured environment. Such opportunities are becoming increasingly important when one considers that cities occupy just 2% of the Earth's surface but their inhabitants use 75% of the planet's natural resources.

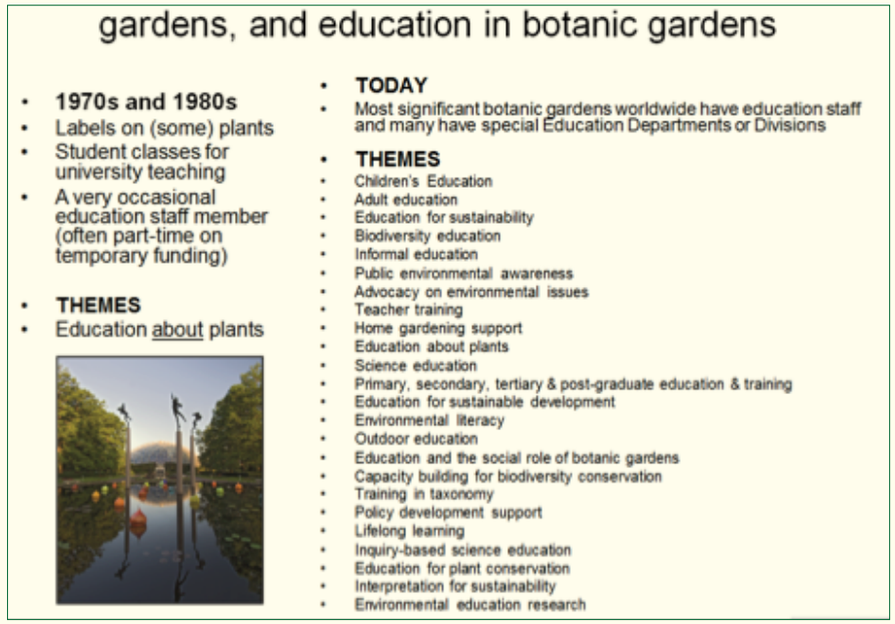

Figure 3. The remarkable growth in the scope and focus of botanic garden educational roles and programmes.

Many examples could be provided to highlight these environmental education trends around the world. However, here I mention an example from the Missouri Botanical Garden which undertakes extensive environmental awareness activities in all regions and countries in which it is active. In this context, the Garden's capacity-building efforts in St Louis and around the world are designed to benefit all citizens living in communities, helping to increase basic ecological literacy and cultivate concern and action around conservation and sustainable living. In its home base region of St Louis, the Garden's long-standing commitment to education has broadened and deepened in significant ways over recent years. From 2010-2013, more than 50,000 adults, 25,000 families with children, and 13,000

seniors and people with special needs participated in the Garden's public classes, ranging from gardening, landscaping and green living to outdoor skills, wellness, and nature study. As part of its work with PreK to Grade 12 (primary through secondary education; 4/6 year olds to 17/19 year olds) students, teachers, and schools, in 2012, the Garden launched its Center for Nature-Inspired Learning, which focuses on specific interventional strategies during a learner's lifetime: the formative early childhood years, the critically important teen years, and the influential roles of teachers. The focus centers on deepening understanding and appreciation of plants, cultivating the will and skills to conserve and protect plants, and significantly increasing ecological literacy in ways that promote sustainable living. From 2010-2014, these programs reached an average of 100,000 local students and teachers each year via on-site classes, labs, and workshops, as well as community outreach programming. Across multiple programs, learning gains among both students and teachers resulted. Teen participants deepened their environmental content knowledge while strengthening their critical thinking and science communication skills. Lastly, participating educators reported increased confidence and skills in the natural sciences and inquiry-driven teaching.

7. Strengthened linkages with local communities

Botanic gardens are increasingly aware that they need to be well rooted in the communities in which they are situated, responding to and helping to meet the needs of those communities. In relation to the Missouri Botanical Garden, in the many regions and countries in which the Garden works, its approach is to develop a community-based focus.

Local communities are often the holders of vital knowledge, including traditional knowledge, about plants and their uses. Worldwide we are aware that such knowledge is rapidly being lost as communities fragment and when knowledge-transmission systems breakdown. Too often information and knowledge is no longer passed on by word of mouth from generation to generation. For that reason the conservation, preservation and repatriation of local and indigenous knowledge is a major research focus of the Missouri Botanical Garden's William L. Brown Center for Economic Botany especially in countries such as Bolivia, Peru and Madagascar. Projects have included the inventorying of traditional knowledge in joint research projects with indigenous counterparts in those countries. Results from communities in several countries have been published in local language books, as requested by communities. Authorship and ownership of this traditional knowledge remains with the local communities.

Capacity building activities and networking between botanic gardens worldwide has been a hallmark of the community of gardens in recent years. For example,

capacity building and networking underpin much of the work undertaken by the Missouri Botanical Garden, including extensive international activities in institution strengthening, as well as professional training of botanical scientists, ecologists and plant conservationists at under-graduate, post-graduate and other levels. The development of close collaborative partnerships between the Missouri Botanical Garden and institutions and organizations in the countries is a fundamental and basic principle and practice that runs through all the Garden's international programmes. In recent years, the Missouri Botanical Garden capacity building efforts have included on-going International Professional Development Fellowships and training courses in conservation and sustainable development, such as ethnobotanical training courses that have been taught by the Garden's staff in Georgia, Peru, Bolivia and Madagascar.

8. Socio-economic roles, including social inclusion

The ways in which botanic gardens are also adopting and responding to a 'whole world' view also needs to be highlighted as they aim to incorporate concerns about poverty alleviation, food security, sustainability, climate change and sustainable development into their missions and programmes in education, environmental-awareness building and plant conservation.

9. Public amenity, relaxation and recreation

Botanic gardens remain outstanding resources for public amenity, relaxation and recreation. Most visitors to a botanic garden do not come for any well-defined educational objective but often simply to enjoy seeing the beautiful garden displays, the rich plant collections or to participate in special events and activities. At the Missouri Botanical Garden in some years, up to 50% of visitors to the Garden are those participating in special events, such as festivals and exhibitions. In recent years these events have included Chinese Culture Days, exhibitions of Chinese Lanterns, an annual Japanese Festival, a Green Homes festival, the 'Best of Missouri' market (where local producers and artisans display and sell their products), a Holiday Lights Festival, called 'Garden Glow, held in December, when the Garden is lit up with hundreds of thousands of coloured LED lights. All of these are part of the 'botanic garden experience'. So too are possibilities for shopping and dining. Many botanic gardens work extremely hard to ensure that there are mission related aspects included in all such activities, even in activities that are essentially designed to help generate revenue.

Conclusions

Botanic gardens face a demanding and ambitious future if they are to respond successfully to the needs of our present and future world. They will need to have clear strategic plans in place to ensure that they are meeting specific priorities. Setting quantifiable and measurable objectives and targets will be helpful to ensure that they can establish and meet agreed goals. Communicating these goals to supporters, governing bodies, funders, partners and staff will be necessary so that their projected roles achieve broad acceptance and agreement. For many botanic gardens it is hard to balance complex and multi-purpose missions in the fields of horticulture, visitor engagement, education, research and amenity, while at the same time funding their operations through grants, earned income, donations, contracts, admissions fees etc. Articulating a clear vision for what they can achieve in a variety of fields can become a valuable means to generate support for their work, rather than being a drain on resources. Much has already been achieved in recent years in botanic gardens throughout the world, of which they can be proud. However, there is no room for complacency. For example, the achievement of botanic garden objectives becomes even more challenging when future scenarios related to the environment and climate change are considered. It is likely that botanic gardens will need to adapt and change their own living collections (and collections policies too) as a response to climate change. They will need to grow plants better suited to new climatic conditions, remove plant species that are or become invasive, cultivate native plants that are threatened by the changed conditions and remove species from the collections that are impacted by newly spreading pests and diseases. The may need to adapt their existing growing conditions too, such as establishing new irrigation systems and putting in place new water conservation measures. They may need to participate in new and innovative programmes in assisted migration and ecological restoration, helping to move and re-establish wild plant species that can no longer thrive in their original geographic range. In addition, still too few scientific assessments have been made on the impact of climate change on plant diversity and plant communities and, to date, there has been little incorporation of climate change mitigation and adaptation measures into National Biodiversity Strategies and Action Plans (Hawkins et al., 2008). Botanic garden research on environmental change and climate change impacts on plants can become an extremely important field of study.

Future opportunities for botanic gardens in the field of research must also be fostered, especially as there is a need to develop more solution-based practical responses to threats to plant species and for the management of plant populations and ecosystems.

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THE SECOND INTERNATIONAL FORUM
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Sustainable Management of
the Botanic Gardens

THE VARIOUS ROLES OF BOTANICAL GARDENS IN THE CONSERVATION OF BIODIVERSITY – THE BOTANICAL GARDENS OF BONN UNIVERSITY AS AN EXAMPLE

Dr Maximilian Weigend, Dr Wolfram Lobin

Dr Maximilian Weigend

Dr Wolfram Lobin

Botanische Gärten der Universität Bonn, Germany.
Email: mweigend@uni-bonn.de; wlobin@uni-bonn.de

Introduction

Botanical Gardens are unique collections of plant diversity, usually in an urban context and – by definition – based on a natural science background. While the history of gardens is intensely linked to human culture, botanical gardens in the strict sense are directly linked to "natural science". Arguably the first botanical plant collections had a medicinal background, cultivating the medicinal plants for the use in the education of physicians. In those days, a clear separation between a natural science approach and a spiritual approach to healing was only marginally present. Nowadays botanical gardens are first and foremost used for teaching and science, and in university botanical gardens this is nominally their main, if not only justification.

Botanical gardens today, however, have a large range of functions. Germany has a very high density with botanical gardens in most major cities. All in all there are almost 100 German botanical gardens, attracting more than 14 million visitors per year. Around one third of the ca. 2500,000 known plant species are currently cultivated in botanical gardens throughout the world, 50,000 of these in Germany.

The Botanical Gardens of Bonn University are – in many ways – a "typical" German Botanical garden, co-founded with, and part of the Rheinische Friedrich Wilhelms Universität. After foundation of the Rheinische Friedrich-Wilhelms-University in 1818, the garden replaced the formal renaissance garden of the castle "Schloß Clemensruh" right in the city of Bonn. This castle was one of many of the former elector and archbishop of Cologne and the gardens are thus a historical compound with a clear ecclesiastical background - they started as a place of contemplation and a pleasure ground.

Two additional parts were incorporated into the botanical garden in the 20th century. Most important, the "economic botany" gardens of the agricultural faculty, with one of the largest collections of useful plants in continental Europe (ca. 2.000 species, varieties and cultivars) was incorporated in 2001. This collection is extensively used in teaching and outreach. After the Second World War, a small garden area was added a few kilometers from the main garden in the outskirts of the town (Melbgarten). This garden has a markedly cooler and moister microclimate and is specifically used for mountain plants from Georgia and western China, which can´t be cultivated in the castle gardens for climatic reasons.

Today, Bonn Botanical Gardens are one of the most beautiful and prestigious botanical gardens with one of the largest collections in Germany. Some 13,000 different Taxa in more than 18,000 accessions are cultivated on its 13 hectares. This is several times the number of the around 3.000 species occurring naturally in Germany. In our collection species of 386 plant-families are present, out of a total ca. 620 flowering plant families (the Plant List, http://www.theplantlist.org/, accessed 02 Oct. 2014), reflecting the enormous phyletic diversity of our collections.

Collections include useful (edible, medicinal, fibre plants etc.), native Central European and worldwide collections, with several focal collections such as Amorphophallus, Boraginaceae, carnivorous and parasitic plants, Proteaceae, Velloziaceae. The main garden ("Schloßgarten") is subdivided into several sections of different character with the renaissance borders ("Parterre") converted into a huge systematic garden, displaying plants according to their natural (phylogenetic) relationships. Other sections are either thematic (fire ecology, "plants of the dinosaurs"), systematical (plant families or orders) or geographical (forests of eastern North America, Japan). Only a small part of the garden is defined as "ornamental garden" in the strict sense, especially near the castle façade and the entrance.

Garden Functions

Research and Teaching.

The primary functions of the gardens are teaching and science, which is clearly reflected in the co-foundation of the gardens with the university. Traditionally, the gardens always cooperated closely with the Nees-Institute of Plant Biodiversity which is under the same directorship as the Botanical Gardens. The gardens collections are extensively used in research projects, mainly at the Nees-Institut für Biodiversität der Pflanzen, but also in other university institutes. Numerous bachelor, masters and PhD thesis with agricultural, medicinal, pharmaceutical and biological themes are largely or completely based on plant material from the botanical gardens. Research material is also extensively handed over to ca. 100 research institutes world-wide each year.

Research projects closely connected with the gardens are investigations into the evolutionary history of plants (phylogeny and evolution), the cataloguing of plant biodiversity (taxonomy) and ecology (esp. floral function and pollination biology). Increasingly, molecular techniques are used by scientists in the Nees-Institute using plant material from the gardens. The gardens inspired an extraordinary number of scientific projects: the so-called 'Lotus effect' was discovered in the 90ties in the Bonn Botanical Gardens. This is a wonderful example and the starting point of bionics, copying from nature, the lotus-effect is used today in such applications as paints for outside walls.

Several university courses at mathematics and natural sciences and at the agricultural faculty are based on plant material from the Botanical Gardens.

Active Species Conservation.

Botanical Gardens collect, preserve and propagate a wide range of plant species. Bonn Botanical Gardens are committed towards the aims and objectives of the Convention on Biological Diversity (CBD) and the Global Strategy for Plant Conservation (GSPC). The Gardens are involved in the implementation of international agreements within the German botanical gardens community. Botanical Gardens are naturally suited for directly contributing to the conservation of plant species, by maintaining viable populations in cultivation (ex-Situ) and providing seed for re-establishing new populations in the wild in designated sites. The conservation of endangered species is therefore one of the priorities of Bonn Botanical Gardens. 62 locally and regionally endangered species are currently taken in cultivation and being propagated in the gardens, in close collaboration with 16 different conservation institutions. 20 have been successfully propagated and plant material has been brought back into the original sites. Endangered plants

are displayed in a public area designated to the "natural biomes of the Rhineland" (Biotopanlage), to inform the visitors about this important task. Additionally, some rare and endangered plants from across the world are here kept in cultivation, such as Toromiro (Sophora toromiro Skottsb.) from Easter Island.

Ex-situ conservation is, in general, particularly easy for useful plants since they are fully adapted to cultivation. Our extensive collection of useful plants, founded by Wolfgang Franke (1921—2001), is outstanding with ca. 2,000 species and varieties. Especially traditional cultivars of the Rhineland play an important role in this collection and are both maintained and propagated, but also handed out to the public on a variety of occasions such as the annual "spring market" of the city of Bonn.

Public Awareness.

Botanical Gardens directly contribute to the preservation of plant diversity, but probably their most important impact is raising public awareness through the public display of plant diversity and education and outreach programs. Words such as 'ecology' and 'biodiversity' are political catchphrases. It is now estimated that there are around 30 million different species of plants and animals in the world, of which just under 1.7 million are known and have been classified scientifically. The remaining 95% will remain unknown to us – the destruction of their habitats (especially tropical rain forests) is progressing too fast to allow us to catalogue all the inventories. Botanical gardens have a significant potential for raising public awareness: In 2013 over 168,000 visitors came to Bonn University Botanical Gardens, an extraordinary number considering the moderate size of the city (ca. 300,000 inhabitants). These visitors are brought in contact with high plant diversity by various actions (e.g. guides tours, exhibitions, information labels). We hope that they develop awareness and appreciation for the diversity of plant life and its intricate ecological interactions. Here, the garden section "natural biomes of the Rhineland" plays an important role for informing the general public about biodiversity in their daily environment. The overall diversity is prominently shown in the systematic section and in the greenhouses with their tropical and subtropical collections.

One of our flagship species is the Titan Arum [Amorphopallus titanum (Becc.) Becc. ex Arcang.] and several thousand visitors visit the gardens at the specifically advertized bloom times of this extraordinary plant. Titan Arum with its spectacular inflorescence is ideally suited for raising public awareness about the consequences of the destruction of tropical rainforests in SE Asia and elsewhere.

As a means of communicating biological contents to the public, special guided tours offered by our "Green School" (Grüne Schule), are a particularly useful means of addressing the general public. In 2013 alone more than 4,000 visitors participated in a guided tour in the gardens in general, or on a range of specific topics. Another means of communicating with the general public is a wide range of press releases and TV-presence. Bonn University Botanical Gardens are very here active and provide a extensive media coverage across the year.

Political Activities.

The Botanical Gardens of Bonn University and many other botanical gardens actively participate in the political dialogue on biodiversity and conservation. Bonn in particularly has been active in topics such as the Global Strategy for Plant Conservation (GSPC) and other international initiatives. The city of Bonn is now the seat of both the Global Crop Diversity Trust (GCDT) and the Intergovernmental Panel on Biodiversity and Ecosystem Services (IPBES). With more than a dozen biodiversity-related international organizations and UN-secretariats, several important national ministries (e.g., Ministry of the environment, Ministry of Agriculture, Ministry of International Collaboration) and an active involvement of the city of Bonn the Botanical Gardens of Bonn University are now situated in one of the most active environments for the interaction of science and politics on the conservation and biodiversity. This special situation is actively embraced by the gardens and reflected in a range of activities, ranging from joint events and outreach programs to a direct participation in the political dialogue by the garden scientists.

Conclusions

Botanical gardens may perform a range of functions, which can be roughly summarized under the headers research and teaching, active conservation, raising public awareness and political activities. The individual situation of any given botanical garden will determine to which extent individual functions are prioritized or omitted from the portfolio. Bonn University Botanical Gardens have a very special situation in being on the one hand a university botanical garden with a clear basis in research and teaching, but at the same time being situated in a very particular political landscape, with the presence of several national ministries and institutes relevant to biodiversity in town and with Bonn being Germany´s only United Nations city with a strong emphasis on biodiversity, emphasized by the recent establishment of both the IPBES and GCDT. This provides a range of additional opportunities and obligations

Botanical Gardens worldwide and especially in Germany are under increasing pressure to justify their existence, mostly because of the considerable cost associated with the upkeep of a large, public plant collection. One problem of most botanical gardens is that only some of their functions are immediately relevant to the institutions providing their funds. Bonn University Botanical Gardens are a point in case - as part of university since they are nominally funded for research and teaching only. This common conflict thus has to be addressed in some way. We believe that qualitative excellence (collection, conservation and horticulture), a high level of public visibility, a clear focus in administrative policies and a high level of political integration are central strong points for the preservation and development of a botanical garden.

Figure Legends

Fig. 1. The "natural biomes of the Rhineland" section of the botanical garden permits visitors to see all major habitat types of the region on few thousand squaremetres in the middle of the city. It is extensively used in both teaching and guided tours.

Fig. 3. Traditional cultivars of useful plants are under particular threat from changes in agricultural practice. The botanical gardens preserve numerous local cultivars and hand seeds and plants out to the interested public. This picture shows one of the near-extinct cultivars of lamb´s lettuce (Valerianella sp.).

Fig. 2. Threatened plants in ex-situ conservation are especially highlighted for the visitors, here Viola guestphalica, one of the few endemic species of North Rhine-Westphalia.

Fig. 4. One of the "flagship plants" of Bonn Botanical Gardens – the giant arum (Amorphophallus titanum) from Malaysia attracts thousands of visitors each year during its short flowering period of only two days.

THE SECOND INTERNATIONAL FORUM
OF THE QUR'ANIC BOTANIC GARDEN
ISLAMIC PERSPECTIVES ON ECOSYSTEM MANAGEMENT

The Role Traditional Knowledge Plays
in Ecosystem Management

THE IMPORTANCE OF TREES AND FORESTS FOR FAITH BASED GROUPS AND SPIRITUAL TRADITIONS ACROSS THE GLOBE

Dr Edmund Barrow

Dr Edmund Barrow
Director, Global Ecosystems Management Programme,
International Union for Conservation of Nature (IUCN)
Email: edmund.barrow@iucn.org

Abstract

Wherever trees are found, they are of cultural importance for the people who live there – whether they are individual trees, or in groves or forests. The resilience of such trees would seem to transcend race, culture and creed. Such trees are an important link between people and nature, as trees, sacred groves, and some of the landscapes they occupy have been revered for thousands of years. This paper explores the importance of trees and woodlands for Faith based Groups and Spiritual Traditions across the globe. It assesses such trees and groves to why they are important to understand which trees are important to more than one faith based group or spiritual tradition and why. Based on this suggestions will be made as to (i) how we can better understand and respect such important trees and areas of trees from the perspective of Faith Based Groups and Spiritual traditions; (ii) how trees and groves can help humanity re-connect more responsibly to our natural world; and (iii) how this knowledge can be better used to improve conservation. In conclusion an understanding of stewardship will help integrate the importance of trees from the perspectives of both conservation and with respect to Faith Based Groups and Spiritual traditions.

1. Background

Wherever trees are found in the world, they are of cultural importance for the people who live there – whether they are individual trees (for example very old trees, or trees where "something important happened"), or in groves or forests (for example where important people might have been buried). The resilience of such trees would seem to transcend race, culture and creed, and trees are an important link between people and nature. Trees, sacred groves, and some of the landscapes they occupy have been revered for thousands of years (Barrow, 2010). Here Sacred groves are one tupe of Sacred Natural Site can be defined as a territory or area of land or water, or "of rich and diverse nature" having special spiritual significance to peoples and communities[1].

All the main religions and spiritual beliefs have a strong connection with nature, as they were founded in times when people depended on nature. But, in our increasingly materially driven world, the separation between religion, spirituality, and our environment widens despite what the sacred texts tell us. We need to reconnect with our natural world. Sacred trees and groves are one way to hold our natural world sacred, to respect and honour the sacred natural sites of all races, colours and creeds.

Conservation and natural resource managers have tended to undervalue religious and spiritual values of nature. But the continued survival of sacred trees and groves despite seeming insurmountable land use, conservation and religious pressures, and changing cultural pressures attest to their importance and resilience (Barrow, 2010). It is clear that sacred trees and groves transcend materialism and consumerism needs. Yet such sites are often treated as idiosyncratic, and not in keeping with contemporary and scientific conservation. Most formal religions ignore, or at best downplay, the contemporary importance of sacred trees and groves (Gadgil, 1987), irrespective of the importance attributed to them in the sacred texts.

People have become separated from the environment in our quest for material wellbeing, exacerbated by population and land use pressures and urbanization, where 54% of the world's population is urban (2014), up from 34% in 1960, and growing at approximately 1.8% per annum[2] . Such materialism weakened our links with our environment. Yet we depend on the integrity of ecosystems and the vital services they provide us with. This growing disconnection from nature poses a major threat to our species, which is a moral challenge, and calls us to

[1] Source: http://sacrednaturalsites. org/
[2] Source: http://www.who.int/gho/urban_health/situation_trends/urban_population_growth_text/en/ , 7/9/2014

examine how we use and share the goods of the earth, what we pass onto future generations, and how we live in harmony with nature (Kolmes, 1999). As O'Donoghue notes (p. 110): "We no longer walk the earth with wonder. Instead of being guests of the earth, we are now crowded passengers on the runaway train of progress and productivity …… We desperately need to retrieve our capacity for reverence."(O'Donoghue, 1998).

Over recent generations, the spiritual view of people's relationship to nature is being replaced by a more mechanistic and reductionist perspective that is no longer alive or permeated with a spiritual presence (McDonagh, 1986). Society is treating the natural environment as if it consisted of separate parts, to be exploited, as nature is being exploited – forests are cleared for monoculture crops, ancient trees are converted into timber, lakes and seas are over-fished and polluted – all to satisfy human-kind's greed. Even the meaning of the term environment, "that which surrounds", or "external conditions or surroundings" sets up a division between human beings and the rest of the world, and implies a duality (false) of organisms and surroundings. Yet ecology, which is the science of relationships between organisms and their environments, emphasizes these relationships, as "Everything is connected to everything else" (Halifax & Peale, 1999; Rueckert, 1996). The intrinsic value of all living things is recognized and humans are viewed as just one particular strand in the web of life (Capra, 1999).

To revive the sanctity of nature requires reviving the experiences of that sanctity. Lao-tzu (founder of Taoism) wrote 2500 years ago of the value of returning to the simplicity, stillness and beauty of nature to achieve inner peace and harmony. Many have written how nature has the power to renew the spirit, to put one in touch with ones self and with the universe. Being connected with nature restores a sense of relatedness to the spirit, to ourselves and to each other (Harmon & Putney, 2003).

Box 1: Religion and Spirituality

Religion refers to a "belief in, worship of, or obedience to a supernatural power or powers considered to be divine or to have control over human destiny; any formal or institutionalized expression of such belief". While spiritual refers to "relating to the spirit or soul and not to physical nature or matter; intangible" (Collins, 1993).

Religious and spiritual organizations and conservation organisations increasingly acknowledge the importance of the environment to people's spiritual and cultural well-being. The Assisi Declaration (1986) calls on the main world religions to commit to conservation of the environment. The Convention on Biological Diversity and other multi-lateral environment agreements call for enhanced conservation combined with enhanced community participation.

In this paper, I use the terms religion (faith, belief, creed, or religious conviction) and spirituality (mysticism, holiness, sacred) to separate formal organizations from our spiritual connectivity with God and nature that many of us experience (Box 1). Spirituality focuses on the cause and involves self-reflection, and involves personal experience which is founded on conscious stewardship. Sacred trees and groves demonstrate the central roles which nature plays in our lives, as the continued existence of sacred trees and groves is testament to their resilience. Even for the secular-minded, woods and forests provide a place for finding peace, silence, beauty – precious values needed to combat the stresses of life (Barrow, 2010). Many trees outlive the short human life on earth by many hundreds and thousands of years, and some pre-date formal religions.

2. Why are trees sacred & important for us

Sacred trees have strong spiritual meanings for people. The reasons vary from the sheer longevity of some trees (yew and baobab trees), to human associations with certain trees. In many African myths, 'man' is said to have been born from a tree (Boachardon, 1998). In deserts, the date palm became the Tree of Life to early Semites and Assyrians (Altman, 2000). The Bible has over 525 references to trees and wood – more than any other organism except humans, and 22 tree species are recognized (Musselman, 2003).

The ancient forests and trees provided people with shelter, food, and medicine, but also helped shape their consciousness. In this context, the Druids of Europe had close spiritual relationships with trees, in a similar manner to the Celts (Bolton, 1975). A similar respect and reverence is still found in eastern religions. Individual trees, have been revered, and in many places still are, and have a sacred and spiritual significance, for many and varied reasons, including:

Ancient trees revered: Many large and slow growing trees were, and are, objects of deep respect, and often spiritual reverence. The ancient yews (Taxus baccata) found in many churchyards throughout northern Europe testify to this mystical aura (Lewington & Parker 1999). Trees are the oldest organism that people will see (Musselman, 2003). The olive (most mentioned fruit in the Bible) is a slow growing and long lived tree (Janick, 2007), and some of the olive trees in the Garden of Gethsemanie are over 2,000 years old, and are mentioned in the Bible (Exodus 27:20, Judges 9:8-9, Romans 11:11,24) and the Qur'an (23.18).

Universally revered Fig Tree: The Bodhi tree (Ficus religiosa), under which Buddha was sitting when he attained enlightenment (Boachardon, 1998; Mansberger, 1988). Homage has been paid to the fig tree in every religion and culture where the fig tree is found. Ficus carica is the first plant to be mentioned in the Bible where

the Prophet Amos was a "Shepherd and dresser of Sycamores" (Amos, 7:14). For Hindus, the mythic World Tree is represented by a banyan (Ficus bengalensis) which sheltered the infant Lord Krishna (Hamilton, 1998). The world tree is associated with the sacred tree of the garden of Eden (or the Tree of Knowledge or of Life), which was probably a fig tree (Porteus, 1996). The genus Ficus is considered a keystone genus of great importance in the maintenance of biodiversity (Hamilton, 1998), and is particularly important for all religons and is referred to in the Bible (Genesis 3:7; Judges 9:10-11; Amos 7:14; Mark 11:13,20; Luke 13:6-9) and the Qur'an (95.01).

Residence of Spirits: In Africa and Asia, the fig tree (various Ficus spp.) is considered holy, and may not be cut down (Porteus, 1996), in a similar manner to the Yew tree in Europe. In India when forests were felled, care was taken to leave majestic trees standing as sacred groves. Bambara villages in Niger usually have a Tamarind tree (Tamarindus indica) where the spirits reside, and among the Galla in Kenya a certain tree is consecrated by a priest as holy (Porteus, 1996). The tamarind tree is associated with the spirits and endowed with values relating to tenacity (Sene, 2003). Markemia lutea is important culturally to the Bagisu people of Uganda for circumcision, grave making and building shrines for ancestral spirits (Okiria-Aketer, 1997). In Ireland and the Isle of Man solitary thorn trees are associated with fairies as a meeting tree. The Waramunga of northern Australia believe that certain trees harbour the spirit of a child. The baobab (Adansonia digitata) has numerous cultural and mythical associations in various parts of Africa and Madagascar because of its shape, longevity, multitude of uses, and as a residence of the spirits (Lewington & Parker, 1999; Porteus, 1996).

Trees adorned: Many societies adorn trees with strips of cloth and other items. In Mongolia people praise the Tamarisk, Birch, Cornelian Cherry and Juniper trees (Urtnasan 2003). The Arbor tree of Aston-on-Clun (Black poplar) in Shropshire (England) is decorated with multi-coloured flags. In northern Scotland, a woodland is festooned with thousands of rags of varying size above the holy St. Boniface's Well (Morton, 2004). St. Ciaran's bush, to the east of Birr in Ireland, is adorned in clothing rags and those who hang the rags offer prayers for special intentions (Morton, 2004).

Tree ordination: In Buriram Province, Thailand, a Buddhist Monk has been ordaining trees as initiate monks to protect them from illicit logging by wrapping them in the sacred yellow cloth of Buddha. These trees have not been cut, because local people working for illegal loggers feel that this would be tantamount to killing a monk. This helped villagers to collectively reconstruct their rights as the protector of the forest, and as a basis for negotiating community rights (Ganjanapan, 2000).

Trees and marriage, birth and death: In Kenya, the Mugumu tree (Ficus thonningii) was planted to honour deceased male relatives or clan ancestors. These trees are sacred, and to fell them is taboo (Kenya Wildlife Service & Forestry Department, 1994). Trees are often planted at the birth of a new era, as a symbol of marriage or birth. Amongst the Sioux of North America, and the San and Hottentots of South Africa, people to be married are first betrothed to a tree. Among the Dravidian people of southern India it is the custom to marry two trees as a mirror of marriage (Boachardon, 1998). In many countries trees may be planted at the birth of a child as a symbol of the tree growing with the child (Porteus, 1996). In some parts of Nepal tree marriage is practiced, for example Ficus religiosa, or to a Neem Tree (Azadirachta indica) (Ingles, 1995).

Sacred as a result of tradition: Sacred groves are connected to Buddhism in China, and are usually planted near temples with species such as Ficus religiosa, Dipterocarpus turbinatus, and Dialium ovoides. Ficus religiosa is one of the most important sacred trees for mainstream Indian religions and religions of tribal societies. The Hindu trinity Brahma, Vishnu and Maheshvara are believed to live amongst the sacred fig trees of Pipal and Banyan. In India, the Tulasi (Ocimum sanctum) has a special place amongst women (Gadgil, 1987; Majupuria, 1988; Natarajan, 1999; Ramakrishnan, 1996).

Trees as National Monuments: For Lebanon (Cedar of Lebanon - Cedrus libani), Canada (Maple – Acer saccharum), and Chile (Monkey puzzle tree - Araucaria araucana), certain trees are national monuments and appear on the national flags.

Temple Trees: In parts of China, holy hill forests in temple gardens were protected. During the 1960's – 1970's many were destroyed, since then, many have been restored and the number of species found is increasing. This recovery of plant diversity not only helps in the conservation of traditional cultures but also benefits the environment (Peng et al., 2003).

Functional uses: Trees comprised the most important of the seven crop species with which the land of Jesus' birth is blessed. These include the Olive Tree (Oleae europea), Fig Tree (Ficus carica), and Date Palm (Phoenix dactylifera). "By the Fig and the Olive" notes the Surat At-Tin in verse 1 (Batanouny, 1993). The Date palm is mentioned in the Bible (Deuteronomy 2:8, Psalms 1:3, and 92, 7-8) , the Qur'an (16.08), and Thalmud (Hareuveni, 1980; Waisel & Alon, 1980). The pomegranate (Punica granatum) is the fruit of Jews, as well as being sacred to both the Egyptians and Greeks. Prophet Muhammad once remarked "Eat the pomegranate, for it purges the systems of every hatred" (Bolton, 1975), and is mentioned in the Bible (Kings 7:18, 20; Song of Songs 8:2) and the Qur'an (6.99). The Toothbrush tree (Salvadora persica or Siwak) has been mentioned in the Hadith and

Sunnah (p. 217): "If I had not found it hard for my followers or the people, I would have ordered them to clean their teeth with Siwak for every prayer" (Batanouny, 1986). Trees are mentioned as a source of food in the Bible (Genesis 1:29), while the Qur'an refers to the use of the olive for food, and that fuelwood is a divine product (Qur'an 36:80 and 56:72).

Other reasons for sacrality: Trees are often associated with the gift of wisdom. In many African communities a special tree is designated as the talking tree or meeting place. Among the Turkana in Kenya, people are named after important trees. The Neem tree became sacred in India as a conscious decision by Hindu society, linked to both utilitarian and intangible values (Harmon & Putney, 2003). The Glastonbury thorn (Crataegus oxyacantha praecox) was brought by Joseph of Arimathea to England, and is believed to flower on Christmas day, giving it mystical properties (Porteus, 1996). Hindus have special regard for Betula utilis (Himalayan birch) revered for the use of its bark in ancient times as paper for the sacred scriptures. The Japanese take care of groves that provide certain kinds of wood needed for temple construction and rituals (Bernbaum, 2004). Some trees are important for rain-making ceremonies and other ritual meetings (Campbell et al., 1993; Mwambo, 2000).

Individual trees from all parts of the world have been and are revered, and this has resulted in the spread of sacred tree species across the landscapes as people protected and planted them. Most of these trees are large and long lived, are a focus for people to honour the spirits, and a visible expression of their importance through planting. The examples cited demonstrate the importance of individual trees in various parts of the world. This is important from both the context of conservation (the variety of species, rarity, age, and some are keystone species), and for religions (the variety of spiritual practices associated, connectedness to nature). Table 1 highlights how often trees and species are mentioned in the sacred texts – over 120 times. While Table 2 shows how some different species are respected in different religious and spiritual traditions.

Table 1: Trees in Islam, Christianity – Mentions in Sacred texts

	Islam	Christianity
Trees (general)	19	23
Grape	12	6
Olive	**6**	**12**
Date	**22**	**8**
Fig	**1**	**13**

Sources: (Janick, 2007; Musselman, 2003)

Table 2: Some Example of trees that are important to more than one faith based group or spiritual tradition?

	Islam	Christianity	Judaism	Hindu	Buddhism	Traditional belief systems
Ficus (diff spp)	✓	✓	✓	✓	✓	✓
Phoenix dactylifera	✓	✓	✓			
Olea europea	✓	✓	✓			
Adansonia digitata						✓ (Africa)
Ocimum basilicum, sanctum	✓			✓		✓ (India)
Zizyphus spina-christi	✓	✓	✓			
Puncia granatum (pomegranate)	✓	✓	✓	✓		
Almond, Apple, Walnut		✓				

Sources: (Janick, 2007; Musselman, 2003)

3. Where sacred trees & groves are found

Sacred groves and sacred forests exist in most parts of the world, and have been important to people for thousands of years (Table 3). They are protected, usually uninhabited, and have strict rules of use. Traditional respect for the environment and access restrictions to sacred sites often led to well-conserved areas with high biological diversity within otherwise degraded environments (Schaaf, 2003). In Ireland in the shadow of groves of Oak Trees, St. Columba established the monasteries of Durg and Durrow, whose names are derived from the oak (Porteus, 1996). Many sacred groves were found across Europe and North America. But, with time and increased pressures, many were destroyed. In Syria forests have retreated from mountains (due to degradation, grazing, cultivation), but there are still many small forest patches, surrounded by agricultural land, which usually mark a Saint's burial ground (Daoud, 2003).

Table 3 indicates the variety of sacred groves and sacred forests. Sacred groves are tracts of relatively undisturbed forest, preserved around sacred or temple structures, or set aside as the abodes of local deities and spirits and may vary in size from less than 1 ha to over 400 ha. Such sites are found in both the old and new worlds, and in temperate and tropical lands. While the size of such sites may not be large, many are biodiversity rich (Box 2), their continued existence is testament to their local importance.

Box 2: Why Sacred Groves are Important

- The sheer age and number of groves;
- Some groves conserve important biodiversity as a by-product of spiritual and religious values;
- Many sacred groves are examples of remnant floral communities, and are important historically and ecologically;
- The traditional and religious management systems for such sacred sites, are also important from the context of conservation;
- The number of sacred groves can create connectivity and could be a future focus for natural forest and landscape restoration, through Indigenous and Community Conserved Areas; and
- As a key point of entry for linking rural livelihoods to conservation.

Sacred groves contribute to rural livelihoods, though use maybe regulated by custom. People may be allowed to collect fallen dry wood, fruit from the forest floor, honey and other products. In some areas cattle grazing are allowed. But the felling of trees is not allowed without the expressed permission of the deity, which, in the Western Ghats in India, can only be obtained through a ritual process known as 'kaul' (Jeanrenaud, 2001). In Nanhini village in Ghana, no one is allowed to enter the sacred grove of the Goddess Numafoa, or ignore her taboos (Jeanrenaud, 2001).

Sacred groves are mainly associated with India, however the concept of sacred groves in India predates the Vedic age in India, though many of these sacred sites were integrated into post-Vedic-Hindhu ritualism (Ramakrishnan, 1996). Though not as well documented, sacred groves are common and important in Southeast Asia, Africa, and South America. Sacred groves maybe the last refuge of endemic and endangered plant and animal species; are store houses of medicinal plants; may contain wild relatives of crop species that can help improve cultivated varieties; may provide for the water needs of nearby communities; and may help in soil and water conservation (Malhotra et al., 2001). Sacred groves are delimited and protected by traditional societies through traditional institutional arrangements,

often not codified, which utilize a set of myths and beliefs (Ramakrishnan et al., 1998). Such groves could be islands of biodiversity as a source of much-needed germplasm for restoration (Ramakrishnan, 2003).

Table 3: Some Examples of Sacred Groves

Type of Site	Examples	Reasons for establishment
Cedar Groves	Mediterranean, Lebanon	Reference to the Cedars of Lebanon go back thousands of year and the Epic of Gilgamesh mentions the Cedar in 3000BC. The Cedar of Lebanon is on the National Flag of Lebanon
Yew trees	Europe	Graveyards where many of the yew trees predate the grave yard and churches.
Redwood Groves	**Pacific coast of N. America**	**Guardians of spirits of ancestors, burial grounds**
Shaman forests	Machiguenga (Matsigenka) in S. Peru	**Small clearings in forest related to symbiotic relationship between the shrub Cordia nodosa and a species of ant – used for protection from evil forces thought to inhabit the cloud forests of the Andean foot hills.**
Kaya Forests	Kenya – Mjikenda people of the coast of Kenya	91 known Kaya forests each covering an area of 10-200 Ha. (total of approx. 6000Ha) - 45 have been formally declared as "National Monuments" and have been listed as World Heritage Sites.
Sacred Groves	Ghana, Zimbabwe, Tanzania , Mongolia, India, Japan	In Japan Shinto and Buddhist sacred groves are common and cover over 110,000 Ha. In Ghana there are over 2000 sacred groves; in China 400; in Nepal 100's; in Tanzania (Zigna group) 660. In India 13,720 described but real estimates of between 100,000 & 150,000
Monastic Groves	**Ethiopia, Eritrea, United Kingdom, Nepal, Thailand**	Developed by different religions, often in areas of forest which either were or have since become sacred. Now many of these groves are sources of important relic biodiversity. Monasteries (and their monks & priests) have protected patches of forest and important trees for hundreds of years, and have planted trees which, over time have been viewed as part of the sanctity of such monasteries – being spiritually connected to the saints that the sites commemorated.

Sources: (Chandrakanth & Romm, 1991; Githitho, 2003; Hamilton, 1998; Jeanrenaud, 2001; Luke, 1996; Meiggs, 1982; Negussie, 1997; Ntiamoa-Baidu, 1995; Robertson, 1987; Sayer, J. A. et al., 1992; School of Agriculture and Forest Science University of Wales & Institute of Biodiveristy Conservation and Research Addis Ababa, 2001; Urtnasan, 2003)

The scale and scope of sacred forests is testament to their resilience in the face of strong population and land use pressures. The truth is we really have little idea of the number and area of sacred groves in different countries and the world, There are 209,444 "formal" Protected Areas (Categories I-VI) in the world (UNEP-WCMC, 2014a; UNEP-WCMC, I. a., 2014b) – yet how many sacred groves are recognized? – all too few, though the literature (table 3) indicates 150,000 or more! Though generally small in area, many sacred groves may be representative of ancient forests and woodlands. Because of the reverence people attached to sacred groves, people's general perception of the groves discouraged encroachment or uncontrolled exploitation. While many of these groves still survive, the pressures, both internal as a result of social change, and external due to conversion or commercial pressures, are increasing. Without more concerted efforts both from the religious and conservation domains, it is questionable how long these groves and the cultures that uphold them can continue to survive.

4. Some Lessons – Spiritual Perspectives

In Islam conservation of the environment is based on the notion that all individual components of the environment were created by Allah for the sustenance of humankind, and other creatures on this planet, and that a meticulous and optimum balance is maintained (Khan, 1999). The Qur'an makes powerful reference to this "due balance" (Qur'an, Sura 15: verse 19)…." And the earth - We have spread it and cast therein firmly set mountains and caused to grow therein [something]

of every well-balanced thing. ". One hadith (saying of the Prophet Mohammed) states, "If the last hour is about to take place, and one of you was holding a palm shoot, let him take advantage of even one second before the hour to plant it". This implies that, even when all hope is lost, planting should continue for planting is good in itself (Khan, 1999; Musselman, 2003).

Environmental philosophers separate values into distinct categories (Posey 1999): anthropocentric (human welfare and concerns); biocentric (assigns moral standing to special characteristics of sentience or awareness, and capacity to strive to certain ends); and ecocentric (values derived from a concern of ecology of whole communities and the interdisciplinary relationships). The religious traditions of West Asia (Islam, Judaism and Christianity) tend to view nature more in anthropocentric terms. Whereas Eastern religions (Buddhism, Hinduism, Shintoism and Taoism) and the cosmovision of most indigenous and traditional peoples relate to nature in more ecocentric terms (Harmon & Putney, 2003).

World religions and spiritual groups need to examine and redefine their genuine purpose with reference to nature and the environment, perhaps in the spirit and content of the Assisi Declaration (Box 3). This could provide the courage to rediscover religious and spiritual foundations in the web of life. It is the duty of us all to contribute to the growing awareness of the relationship between man and nature; use, not appropriation; respect not exploitation (Prsewozny et al., 1987), and sacred trees and groves are an important visible example of this. The religious view of nature requires re-understanding what nature is, and who we are as human beings who act upon nature, because it is impossible to discuss nature without discussing the image that we have of ourselves (Nasr, 1998). As El-Naggar notes "… man is clearly and irrevocably interwoven into the fabric of his environment. By corrupting its ecosystems, he is clearly damaging himself" (El-Naggar, 2014).

Conservation is spiritual, in the sense that people treat the world according to what they believe about it (Harris, 2000). Given the importance of nature in the major sacred texts, formal religions, in particular the Abrahamic ones (Christianity, Islam, Judaism), could improve on how they embrace and promote the sacrality of nature, sacred trees and groves – irrespective of how important such aspects are to different groups. They could promote the role of spiritual values of the environment in wider society, as nature is not normally part of everyday teachings of religion, despite the many references in the important religious texts. Now, more than ever, the pressures on our natural world – of unsustainable use and conversion, of climate change –reflect our separation from our connectedness to nature. This calls for an important role which the major religions and spiritual groups of the world need to play in the field of conservation. This is starting to happen (Box 3), but has yet to really inform conservation and religious practice at the pragmatic and local level in different societies.

Sacred trees and groves, and their institutions have survived in spite of seemingly insurmountable pressures, both for land and for human survival. Often trees and groves have been ignored by many major religious groups – indeed many such groves and trees have been desecrated by other religions or spiritual groups. They are an important natural and spiritual heritage, and this obligates conservation or stewardship of such trees and groves in the context of our spirituality and our relations with God. In Islam, man is considered to be both a vice-regent on earth, and a trustee for its ecosystems (El-Naggar, 2014), "and remember when your Lord said to the angels: 'Verily I am going to make a vice regent on earth' (Sura 2:30). When nature is understood as the creation, and its dominion calls for greater inter- and intra-faith harmony, as well as reaching out to the environmental movement, then there is, from the perspective of religion, a need to (Barrow, 2014 in preparation):

1. Improve our understanding of people's spiritual and religious views of nature, trees and forests, as to what this means for religion and spirituality, and to support a fuller appreciation of nature;
2. Acknowledge and understand the value of sacred trees and groves in terms of the spirituality of local people, irrespective of religious or spiritual belief;

Box 3: The Assisi Declarations

In 1986, representatives of the great faiths of the world came together to discuss what religion had to offer to conservation, and what conservation had to share with religion. The central message from the Assisi declarations was that ecology needs the deep truths, which live within the major faiths of the world, if people are to recognize their responsibility for, and with nature. The major faiths present issued declarations with respect to their commitment to the environment and conservation – Buddhism, Christianity, Hinduism, Islam and Judaism. Three faiths joined later – Baha'i (1987), Jainism (1991) and Sikhism (1989). As HRH the Duke of Edinburgh summed: "A new and powerful alliance has been forged between the forces of religion and the forces of conservation". Source: (Posey, 1999)

3. Implement at national and local levels, the contents of the various agreements concerning environment and religion, including the Assisi Declaration, by developing and implementing plans of work to address the integration of environmental issues in pastoral work;
4. Emphasize in religious teaching the importance of the environment, natural resources and trees, and their restoration;

5. Appreciate the variety of social institutions and organizations who have responsibility for the management of such areas;
6. Take increased responsibility to address the conservation and environmental crisis, in particular with respect to trees and forests;
7. Engage with conservation organizations to better manage, recognize and respect sacred trees and groves so that they can be acknowledged under the different IUCN Protected Area categories; and
8. Redefine and reaffirm our religious and spiritual roles and responsibilities with respect to the environment, and in particular to forests and trees.

Box 4: Some Principles For Working With Sacred Values And Conservation Areas

1. Determine the values and resulting management decisions in a participatory manner, and involve local people as "owners";
2. Record community knowledge, oral histories, and place names as a good way to articulate intangible values;
3. Management decisions need to flow from an understanding of all of values of the landscape, both tangible and intangible;
4. Values that appear to be in conflict must be carefully examined to determine whether there is really a conflict and, if so, exactly what it is;
5. Monitoring is essential to achieving sustainable protected landscapes that recognizes and integrates cultural and spiritual values; and
6. It is important to define a moving scale of limits of acceptable change to reflect natural and cultural evolution and changing values.

Source: (Harmon & Putney, 2003)

5. Some Lessons – Conservation Perspectives

Historically, conservation tended to belittle the importance of sacred groves and trees – "too small to be viable, no connectivity in the landscape, and they don't conserve important species" - arguments now being refuted, as

- Connectivity can be re-created using a combination of land uses, including sacred nature;
- Many sacred sites contain endemic species and so demonstrate the importance of sacred groves and biodiversity; and
- Sacred natural sites offer real opportunities for Indigenous and Community Conserved Areas that are community owned and managed.

Western conservation approaches are beginning to recognize and value the relationship between local environmental knowledge and communities, and between scientific and spiritual perspectives. Conservation may be more efficiently achieved through connectivity, combining, for example, community reserved hillsides or sacred groves with a national park or a community conserved riparian area. Recognizing connectivity in the landscape, and the need to negotiate trade-offs to make optimal use of the environmental goods and services may well be more sustainable than alienating further lands from people. Harmon and Puntney (2003) have suggested a number of principles to recognize the importance of sacred values (Box 4).

This argues for decentralizing rights and responsibilities to the local level for sacred groves in terms of management together with the appropriate institutions, together with the active formal recognition of those rights and responsibilities of those sacred sites. Responsible decentralization should give locally based customary institutions, such as those responsible for sacred groves, greater responsibility for natural resource management, and such management should be respected at all levels. A clear understanding of these institutions would enable a greater synergy between decentralized Government institutions, such as village committees and parish councils, and existing customary institutions, such as traditional spiritual leaders. This would reduce institutional conflict, and create the space for greater community cohesion and improved natural resource management, together with the greater formal recognition of, and respect for sacred natural sites.

It is ironic that many of the more successful examples of sacred sites and sacred groves are successful because they have cut out 'middlemen', in most cases government conservation agencies (Jeanrenaud, 2001). Local respect and sanction has been sufficient, especially when such sites have been declared sacred. But therein lies a paradox: while local respect and sanction may have worked in the past and still does in many places, it is increasingly difficult for those responsible for sacred sites at the community level to withstand globalization, and local or external political pressures. Many sacred sites have been included in areas gazetted as National Parks. Others have been converted by unscrupulous business interests and politicians. For instance, a number of Kayas (sacred groves) along the Kenya coast have been cleared for the development of coastal tourism facilities.

Indigenous and Community Conserved Areas (ICCAs) offer a very important opportunity for the greater recognition of sacred groves and sacred sites. ICCAs "natural and/or modified ecosystems, containing significant biodiversity values, ecological benefits and cultural values, voluntarily conserved by indigenous peoples and local communities, through customary laws or other effective means" (Kothari et al., 2012). Table 4 provides some examples of how different sorts of scared groves as ICCAs could be included in the different IUCN Protected Area (PA) Management Categories.

Table 4: Some Examples of Sacred Groves in the different IUCN PA management category which could be more formally recognized

IUCN PA management category	ICCA type & Examples of Sacred Sites/Groves
Categories Ia and Ib Strict Nature Reserve and Wilderness Area	Sacred or otherwise 'no-use' groves, lakes, springs, mountains, islands etc. no use except on very particular occasions, e.g. once-a-year ceremony many Sacred Natural Sites fall into this category, e.g. Garden of Gethsemane, Cedar Groves of Lebanon
Category II National Park	Community declared sanctuaries (at times also for ecotourism use), for example many sacred groves in Ghana, India
Category III Natural Monument	Natural monuments (caves, waterfalls, cliffs, rocks) protected by communities for religious, cultural or other reasons. Kaya forests in Kenya – many of which have already been gazetted as National Monuments.
Category IV Habitat/Species Management Area	Wildlife populations, sea turtle nesting sites, watershed forests, community managed wildlife corridors and riparian vegetation areas, for example Shaman forests, some sacred groves in Ghana
Category V Protected Landscape/ Seascape	Sacred and cultural landscapes and seascapes such as Himalayas, Ganges, Mt. Kenya many of which include sacred groves
Category VI Managed Resource Protected Area	Resource reserves, for example community forests, grasslands, waterways, etc. under regulated use and communal rules that assure sustainable harvesting through time, e.g. Monastic forests, some sacred groves in India, Ghana, China

Source: Adapted from (Kothari, 2006)

Forest and conservation authorities need to move away from mechanistic views of conservation, and become more integrative, interacting with the different religions with respect to the management of forests, especially sacred ones. Forest and conservation authorities could engage in a range of activities for the improved management and conservation of such areas including (Barrow, 2009, in preparation; Putney & Schaaf, 2003) to:

1. Improve our understanding of people's spiritual and religious views of nature, trees and forests;

2. Understand traditional, customary and local institutions, which are responsible for sacred grove management, how these can be strengthened and made more inclusive yet respecting local rights;
3. Implement at national and local levels, the contents of various agreements concerning environment and religion with respect to improved policies, laws and practice, e.g. the provisions of the CBD and the Assisi Declaration);
4. Develop and implement plans of work to address the more responsible integration of religious and spiritual values and issues into forest conservation;
5. Better understand biodiversity and conservation values of sacred trees and groves, including the mapping of sites and assessment of species;
6. Assist communities to gain greater statutory recognition of the sacred trees and groves through improved and stronger tenure arrangements;
7. Redress past inequities, where many sacred groves and sites were, often inadvertently, reserved as Parks or Forest Reserves;
8. Acknowledge that the variety and range of tree species which are considered sacred is important in itself;
9. Understand that, while biodiversity conservation is not a primary objective for sacred trees and groves, many sacred groves conserve important biodiversity; and
10. Support management approaches that foster greater connectivity in the landscape.

6. Stewardship – Connecting Sacred Nature and Conservation

From the perspective of sacred trees and groves, the principle of "stewardship" is key to integrating the management of sacred trees and groves into conservation and religion. Stewardship is to hold something in trust for another (Osland, 1999), and combines the need to sustainably manage natural resources and understand that these resources are more than their utilitarian and economic values. Stewardship represents the "glue" for better and more coordinated action to conserve the world's valuable natural heritage, as it is embraced by religious and spiritual, and conservation groups. Stewardship implies present and future responsibility for the environment, and acknowledges the many and varied roles trees and forests play in our lives. Both stewardship and conservation as terms have similar values: use, not overuse, recognize interdependencies in the natural world, and emphasize the importance of future generations.

Stewardship springs from impeccable religious and spiritual fundamentals, and it means that we bear the responsibility to develop rather than to deplete, to use rather than to abuse, with prudence rather than with greed, and to pass the world

to our children in a better state than that in which we found it (Goodland, 1990). Attitudes of dominion and stewardship in the religious texts are nurtured by the four virtues of simplicity, moderation, frugality and gratitude. Concern for the future and especially for justice is defined as the fullest possible flourishing of all creation, and this should set the tone for ethical discussions about our relationships with nature (Baasten, 1999).

Stewardship from a spiritual perspective is expressed in many differing ways. Amongst Aboriginal groups in Australia it is "looking after country" (Hill & Press, 1994), while Andean Quechuas speak of caring for Mother Earth. Indigenous and local peoples have much to teach about stewardship, as they developed a spiritual relationship with the environment that is often insightful, protective, visionary, and reverent, and the language and images they use are often expressed in poetic and visual terms (Kleymeyer, 1994).

In the Biblical context, stewardship refers to humankind's responsibility for carefully husbanding God's gifts - "the Lord took the earth creature and put it in the Garden of Eden to till it and keep it" (Genesis 2:15). All too often Christians have tragically misapplied God's words to the newly-created Adam, "Till the earth and subdue it; and have dominion... over every living thing" (Genesis 1:28). 'Dominion' does not signify 'domination', and the Bible says that this dominion is given to people specifically because they are made in the divine image (Kallistos - Bishop of Diokleia, 1995). Dominion means "rule, authority", but the implication is one of "care" or good stewardship in taking care for natural and human resources (Osland, 1999).

Stewardship is also firmly embedded in Islam, as Allah (God) created human kind and other creatures of the earth for a purpose. " He (Allah) is the One who made you vice-regents on the earth"(sura 35: verse 39). The human is God's 'vice-regent' of the planet, meaning that human beings are caretakers of the environment – not the plunderers. The human community has to live and act in ways that do not upset the balance of nature. The Qur'an states that "Allah has created the Earth and things on it in balance". Islam emphasizes that "any mishap exercised on the surface of our planet will be accounted for in this world and in the world to come", and warns against corrupting the environment, and advocating for a balanced relationship between man and his ecosystem as the basis for sustainable use and conservation (El-Naggar, 2014). If human communities act and live in ways that disrupt this balance, then it will bring disaster on all people, as well as all creatures on this planet (Khan, 1999).

Stewardship of nature relies on the linkages between the social and environmental pillars, and can help achieve sustainable development. There are many challenges to translating this into reality in terms of sacred natural sites, sacred trees and groves (Putney & Schaaf, 2003). Stewardship can enrich our meaning of sustainable development by promoting the importance of the spiritual, intangible and other cultural aspects of how we live as part of the natural world. Yet spiritual and religious aspects of stewardship are not fully appreciated. So religious and spiritual organizations need to acknowledge and re-affirm the importance of the stewardship of nature as a core component of human spirituality. Then this needs to be translated into practical action to promote stewardship as part of spiritual work.

From the perspective of sacred groves, the ecosystem approach (Shepard, 2007), with its twelve principles and recognizing that societal choice and management should be devolved to the lowest appropriate level, offers a more holistic approach than, for example most practices of sustainable forest management (Sayer, J. et al., 2004). This could include a number of characteristics in common including to:

- Respect that sacred trees and groves have survived despite high land use and population pressures;
- Understand that, while many sacred groves may be small in area, they may be very numerous, and there are many more sacred groves and sacred trees than formally acknowledged;
- Have the awareness that many such sites assist in biodiversity conservation;
- Understand that partnerships and alliances – among local communities, government, non-governmental organizations and the private sector – are essential, and can provide a legal basis and incentives for both recognition and management;
- Represent conserved landscapes as a tangible means of achieving conservation objectives on private and community lands;
- Develop conservation stewardship education and leadership so that the study and management of sacred natural sites is embedded in training and capacity building programmes;
- Reconnect people with place, and build a greater understanding of conservation stewardship and its potential benefits to society; and
- Strengthen the ability of practitioners to practice effective conservation stewardship, and encourage new forms of leadership at the community level, which will further partnerships for nature conservation stewardship across sectors (Brown, 1998).

Human centred values are particularly important today as conservation moves to address issues of cultural diversity, quality of life, and social justice. Stewardship considers the needs and responsibilities of humans in relation to ecosystems and cultural traditions. Here, recognizing ICCAs offers us a pragmatic way to

conserve nature, sacred trees and sacred groves. They are one way to practice our stewardship of nature. The two main determining factors are that the local community should be the stakeholders in decision making, and that the efforts should lead towards the conservation of biodiversity. ICCAs can and do provide one solution to humanity's troubled relationship with the Earth, and could be crucial components of conservation policy and practice, as the CBD has recognized (Kothari & Pathak, 2008).

7. Stewardship of What for Whom?

It is a challenge for two seeming very different groups (religious and spiritual traditions, and conservation) as to how they can work together so that spirituality becomes more meaningful to people and to the environment. This argues for the development of mechanisms within religious, spiritual and conservation contexts to understand why various natural resources are important from a spiritual context, and how this can improve conservation:

- Why do sacred areas and trees have spiritual and religious significance?
- How to understand sacred trees and groves from biodiversity and conservation perspectives?
- Find practical mechanisms that religions and spiritual groups can use to integrate conservation values in their work;
- Reinforce mechanisms to conserve sacred groves and species, where conservation is based on the group for whom such areas are sacred; and
- Create awareness on the scale, scope and extent of such areas and species more widely to both conservation agencies and religious bodies.

The Assissi Declaration provides strong support and guidance for greater religious responsibility for conservation. The CBD provides strong support for community-based approaches to conservation so that ecology now needs to be articulated in local and national levels. If this happens, then society may return to the "sacred loop" of harmony, cooperation and community, to a "one-ness" (Rueckert, 1996).

It is possible to use sacred sites as indicator sites for conservation, and foster, the restoration of degraded areas. Scientists and custodians of sacred sites could work together with a view to better understand the mechanisms for culture-based environmental conservation and formulate guidelines for decision makers for enhanced protection of such sites. Natural scientists need to inventory and study the plant and animal compositions in natural sacred sites to demonstrate their importance to biodiversity (Schaaf, 2003).

In this increasingly deforested and materially driven world, the healing concepts of restoration, repair and rehabilitation have an emotional appeal on which conservationists have not yet capitalized (Hamilton, 1998). Those three 'R's' are more than the act of planting trees or technical forest restoration of degraded landscapes. If such activities can be imbued with sacredness, then we will be truly helping nature to take care of itself through the active and spiritual involvement by human kind. While sustainable development, livelihood security and poverty reduction are key goals for the world, this must be seen as part of, not separate from our linkages with nature, and how we need to help 'Heal the Earth'.

We are the trustees of Nature, these trees and groves, and our future on earth. We need to act as trustees of nature & the environment. Only then are we being trustees of human life, and this will

bring peace and tolerance in our times. As Mahatma Gandhi said: "There is enough for everyone's need, but not for everyone's greed" (Murphy, 1991). We must connect more with nature, and know that nature is sacred. The environment and nature are held in trust for future generations and for the future of the world. To become responsible trustees requires transcending differences, within or between the different religious and spiritual groups, and between religion and conservation. This implies that a much greater tolerance for other peoples and groups views with respect to trees and sacred sites. It is clear that sacred trees and sacred groves are universal, and transcend nationality, race, and religion. But it is equally clear that respect and acknowledgement for such sacred trees and forests is not given the importance deserved, either by conservationists or from the major religions. There is a clear opportunity for much greater collaboration between religions, faith-based groups, and conservation and environmental groups to conserve and respect Earth's precious heritage. But if humanity can take on its responsibility as the stewards and trustees of nature, the future will be brighter for people and the rest of nature, and this will help us all transcend out differences.

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THE SECOND INTERNATIONAL FORUM
OF THE QUR'ANIC BOTANIC GARDEN
ISLAMIC PERSPECTIVES ON ECOSYSTEM MANAGEMENT

The Role Traditional Knowledge Plays
in Ecosystem Management

SPIRITUAL VALUES IN CONSERVATION- A CASE STUDY FROM MONGOLIA

Dr Pieter Wit

Dr Pieter Wit
Board Member of the Hustai National Park Trust, Mongolia
Email: wit.syzygy@gmail.com

Abstract

For Mongolian people, their traditional landscapes are not only composed of abiotic and biotic elements, they also encompass spiritual values. The Mongolian countryside is dotted with monuments and other signs of cultural reverence to the spiritual values of landscapes and nature. Mountain passes and mountain tops are marked by an "Ovoo" where respect is paid to the spirits of the valleys and the mountains.

This respect for nature in all its appearances dates back from a long time. In Chinggis Khan times specific rules were set and applied to protect the streams on which nomadic life still depends, notably during the dry summer periods. One of our world's oldest protected areas (since 1778) is Bogd Uul, a sacred mountain overlooking Ulaanbaatar, Mongolia's capital. About a hundred kilometres to the West lies another sacred area around Hustai Mountain, the first place where travellers coming from the Gobi desert, will see patches of Birch forests on the northern slopes of this outlier of the Khentii mountain range. It is here that the Takhi or Przewalski's Horses, Equus przewalski, have been successfully reintroduced. This reintroduction was initiated when after a centuries-long reign by foreign powers, Mongolia was discovering its own identity again. And the Takhi have become part of Mongolia's reborn cultural identity.

This article elaborates on the cultural roots of the Mongolian people in relation with its natural values and the weakening of some of these spiritual values in modern times. It ends with some observations on how to strengthen the culture-nature interaction in a Mongolian context and how to set priorities for conservation in the country in future.

Introduction

During the era of Chinggis Khan (who died on 1227 1t the age of 66) the large empire of Mongolia was a rare example of religious tolerance: Traditionally Mongolia was a shamanist country; Chinggis shortly before his death gave preference to Taoism; one of his successors, Güyüg Khan was sympathetic to Christianity. Buddhism came to Mongolia in the eleventh century, was adopted by the powerful emperor Hubilai Khan (who died in 1294), but it took a few more centuries before it became firmly rooted in Mongolia. The Tibetan "Yellow Buddhism" has adopted many shamanistic elements and is Mongolia's leading religion until this day. In the first half of the twentieth century a small community of Kazakh refugees from Xinjiang (China) settled in the Western Aimag (Province) of Bayan Ölgii (Baabar, 1999). Traditionally these people are followers of Islam.

This article describes some of the more obvious manifestations of Buddhism and Shamanism in relation to nature and ecosystems in Mongolia.

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Spiritual values of nature in Mongolia

In the Mongolian spiritual tradition all elements of ecosystems, be they abiotic or biotic, have a soul and should be treated with respect. Ecosystems like forests, valleys, mountains or water courses have their own spirit (Purev Otgony & Purvee Gurbadaryn, 2006). Wit & Vegter (1998) describe a number of "cultural focal points" in the landscape of Hustai Nuruu in Mongolia[1] . The most visible of these "focal points" are the Ovoos .

"Ovoos are cairn-like piles of rocks, branches and other natural materials, sometimes with religious paintings or figures placed inside" (MNE, UNDP, WWF, 1996). Most Ovoos are heaps of stones in which sticks are planted to which blues scarves ("hadach") are attached, but sacred trees and stones with hadachs and other objects of devotion can also be observed in the countryside. More elaborate structures are installed at places of high spiritual value such as large passes. To pay respect to the spirit of the ecosystem where the Ovoo is erected, one has to go clock-wise around the Ovoo three times and put at least one additional stone to the structure. At the larger Ovoos ceremonies are held where food and drinks may be offered (Wit & Bouman, 2006; GTZ, 2010).

[1] A cultural focal point is defined in this publication as: Concrete evidence of human presence (in the past or present) in the form of permanent or semi-permanent structures at a specific spot in the landscape. Characteristic for these focal points is that they derive part of their value from their position in the landscape adding a spiritual dimension to their existence at that specific locality.

Some mountains are places of special worship. For instance the Otgontengel volcano, the highest mountain of the Khangaï range, or Bogd Uul Mountain overlooking the capital Ulaanbaatar. Bogd Uul Nuruu has been officially protected since 1778, about a century before the creation of Yellowstone National park which often is mentioned as the starting point of modern conservation.

The attitude of Mongolian traditions towards animal and plant species can be rather ambiguous. Seeing a wolf for instance is supposed to be a good omen, but the animal is hated for the killings of livestock that it accused of, and it is heavily prosecuted. Parts of the wolf's carcasses are sold as medicine and fetching good prices at the local black markets.

Siberian Roe deer are heavily hunted especially in spring, when they feed upon the first plants sprouting from the earth after the long winter, like Pulsatilla species. These plants are full of the power of the earth, passing it on to the Roe Deer (Dashpuurev Tserendeleg, personal communication).

Most monasteries have been destroyed during communist time, and the spiritual protection of the area where they were located mostly disappeared with them. Since the 1990's restoration efforts have been going on in about 100 monasteries (Charleux, 2009).

Traditional legislations with respect to nature

Bernd Steinhauer-Burkart summarizes the history of Mongolian environmental legislation in a GTZ brochure (2010). The following texts are mainly from this source.

In 1210 AD, the traditional respect for environmental issues was laid down in the Ikh Zasag. Although the original text has been lost, some of the regulations came to us through Persian and Arab channels. The Ikh Zasag provided regulations on water pollution and fire control, but also on the appropriate use of rangelands as the soil is sacred and should not be unnecessarily damaged [2]. Hunting regulations provided some protection to the fauna.

Not surprisingly, punishments were very harsh in Chinggis Khan's time, and often capital punishment was the rule.

The Yuan Codex dates from Hublai Khan's time (1260-1294). It builds on the Ikh Zasag and specifies a/o hunting seasons, and prescribes reforestation along water-courses, roads and in settlements.

Old Tsaazyn Bichig dates from the16th century and is supposed to be at the basis of the Oirat Codex which is also called the new Tsaazyn Bichig (1640). The text has been conserved until these days and provides great insight into the Mongolian legislation of the time. It addresses pollution, e.g. the clearance of carcasses of livestock that died after a natural disaster like severe winters or drought, prescriptions about (not) taking baths in rivers and streams; it established hunting zones for the ruling classes; some animals were declared fully protected (including snakes and frogs); local authorities were charged with conservation and were expected to ensure that the proper ceremonies would be regularly organized at sacred places. Punishment was mostly in payments of property.

In 1709 the Khalkh Juram was imposed. Steinhauer-Burkart states that for many this is Mongolia's most important legislation. It deals a/o with the establishment of green zones and with environmental inspectors to control exploitation in these zones; there is a general ban on hunting during reproduction periods and non-game animals are to be conserved and protected areas came under provincial ("aimag") rule. There also was not only the stick, but also the carrot: positive incentives are put in place for sound ecosystem management (e.g. for maintenance of waterholes or for fire control).

Modern times

During the communist era, not only religion was suppressed but also traditional nomadism was in many places exchanged for centrally guided exploitation of the range lands. As a consequence traditional knowledge about natural resource management often was lost or became obsolete. The communist rulers promoted rational use of natural resources as the base for sustainable livelihoods. Grazing and hunting were strictly controlled. Communist dignitaries had privileges to hunt in special zones such as around Hustai Nuruu Mountain - a traditionally sacred area where the first stands of Birch Forests can be observed for travelers coming from the Gobi desert (Wit & Vegter, 1998). As a result, Mongolia teemed with wildlife when democracy knocked at its doors.

[2] Purev & Purvee (2006) mention how shamanistic rules until today prescribe actions to heal the earth after a pole has been driven into it for the erection of a ger (Mongolian tent) .

Still, in spite of the suppression during the communist time, many traditions and beliefs remained present in people's minds. Until this day, the Dalaï Lama is by many considered as the holy father of the nation (Jachin Tserendeleg, personal communication). This consciousness about the importance of Mongolia's cultural heritage became manifest when a large crowd turned up at Ulaanbaatar's airport to welcome the return of Takhi (or Przewalski Horse) to be reintroduced after its extinction in the wild, in an area surrounding the sacred Hustai Nuruu mountain range. The return of the last representative of a truly wild horse was seen as the symbol of a new Mongolia, reborn after ages of suppression of its own identity under Chinese rule and Russian domination. In the Mongolian culture where the horses have a central place, nomads and city-dwellers alike readily identified themselves with the wild horse and the good fortune it will bring now that it came back to their country. Such optimism was also reflected at the Earth Summit in Rio de Janeiro (1992) where the Mongolian Government made the offer to the world to declare the whole country a Biosphere Reserve (Wit and Bouman, 2006).

Since that time the cynical powers of a more capitalistic society, benefitting from a transition period with political weakness, have depleted for a good deal the pristine beauties of Mongolia. Locally mining sites have altered complete landscapes and pollution from these mines may reach as far as Lake Baikal in Russia (Lonely Planet, 2012). Wildlife numbers have gone down dramatically, partly because of the revival of shamanism and the belief in supernatural powers in trophies from sacred animals like Owls, Vultures, etc. that are readily (albeit illegally) for sale at Ulaanbaatar's black market.

The changes in legislation after the Mongolian "perestroika" did away with some of the more detested provisions of the communists' legislations, but did consider insufficiently the requirements for protection and conservation of the resource base. The freedom to move and to settle everywhere on traditionally commonly owned lands (see also Ziegler & Hogh, 2005) has led to a concentration of herdsmen with an ever growing number of livestock around larger cities causing serious overgrazing and increased vulnerability to natural disasters. (Wit & Vegter, 1998; Wit & Bouman, 2006).

The future

In recent years we have seen the emergence of a green civil society in Mongolia, not unlike in other countries. This development needs further strengthening to stop the destructive depletion of the country's natural resources. Politicians realize more and more that unpopular measures need to be taken to stop land degradation. This includes further refinement of the legislation about ownership and uses of land and water in order to prevent overgrazing and deforestation; environmental impact assessments; ecosystem restoration for abandoned mining sites; etc., etc...

Mongolia's youth is most impressed with the economic achievements of capitalistic societies and as a result studies in economics and IT but also in law are popular. Disciplines touching on natural resources and their management do not meet with the same amount of enthusiasm. For all these studies however (natural resources, economy and others), it is highly recommended to integrate a basic knowledge about Mongolian culture and how respect for nature has always been an intrinsic part of Mongolia's identity.

Parallel to the physical restoration of monasteries (UNESCO, 1996) Lamas should also strengthen the green roots of the Buddhist faith, and do so more and better than presently is the case. Representatives from Mongolia's Green Society should join hands with the lamas and monasteries in order to conserve - together with the government and the private sector - a Mongolia that will be better prepared for the environmental challenges of the 21st century.

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The Role Traditional Knowledge Plays
in Ecosystem Management

MANAGEMENT OF LANDSCAPES OF SPIRITUAL IMPORTANCE FOR DIFFERENT FAITH GROUPS: BEST PRACTICES AND SOURCES OF INSPIRATION

Mr. Josep-Maria Mallarach

Mr. Josep-Maria Mallarach
IUCN WCPA, Specialist Group on Cultural and Spiritual Values of Protected Areas
Email: mallarach@silene.es

At the time when the trends of the global ecological crisis are creating global risks of unprecedented magnitude that not only threat biodiversity, but human life, can mainstream religions inspire a reaction to conserve our life sustaining heritage? Can they promote and provide examples of best practices on conservation of ecosystems or landscapes?. And if so, can religious principles inspire bold initiatives for conservation or restoration today? Why it is important for conservationists to seek alliances with religious organisations?

All these questions have already been answered, to some extent, from different angles during the last years (Tucker & Grim; 1988; Hamilton, 1993; Berkes, 1999; Palmer & Finley, 2003; Gardner, 2003; Harmon & Putney, 2003; Dudley et al., 2005; Pungetti et al., 2012). This paper will try to provide another answer based on the case of landscapes that are spiritually significant for different mainstream faith groups. The type of significance these landscapes actually have is receiving an array of different names in the world's languages, embodying a high diversity of concepts and nuances, which could be loosely translated as inviolable places (arām or arim in Arabic), holy sites, sacred sites, places of power, numinised natural places, etc.

According to the most reliable estimates, over 85% of humankind is related to one or another faith. Christianity and Islam together account for more than 50%, and a great deal of their followers are living in the most biologically rich and often economically challenged parts of the world (O'Brien & Palmer, 2007; Denny & Smart, 2007). Therefore, one could argue with K. Golser (1995) that Christianity and Islam have a greater responsibility than the other faiths.

All the main religions of the world share the consideration that nature has intrinsic, spiritual, values and that the proper behaviour for humans is to consciously respect nature, and carefully manage all the natural resources, services and benefits that nature provides not only for our sustenance and enjoyment but for the rest of the living creatures. Most traditional cosmologies agree that there exists several levels of reality / being / consciousness, and the corporeal level is the 'lower' reflecting 'higher' / spiritual levels. Critically important consequences follow from this cosmological concept, such us ethical boundaries for science and technological development (Nasr, 1996).

Most religions and faiths possess elaborated cosmologies and provide clear guiding principles for humans' relation to the natural world, in a prudent, harmonious and responsible way. Paradisal landscapes and gardens have been created and established in many countries as a reflection, or reminder of celestial harmony. Islamic gardens provide outstanding examples of this outlook, as has been eloquently showed (Clark, 2009; Hamed, 2012) among others.

From the dominant concept of Nature many intrinsic values arise in every culture, developing diverse links between human communities and individuals with Nature...beyond use values: in respect, awe, reverence, meditation or contemplation...all of them having very significant implications for they shape the particular ways that each society, or local community, relates to nature. Moreover, all religions use natural elements in their rituals, and have rituals that remind humans being their interconnectedness with nature. Moreover, all religions share the view that proper rituals have an array of beneficial effects on the health and harmony of nature, even if this challenges modern assumptions (Nasr, 1996).

In most cosmologies, the beauty and harmony of spiritually significant landscapes is often understood as the outer reflection of the truth and beauty of the principles and values of the spiritual cosmologies that sustain them. It seems appropriate to recall the well known hadith: "God is beautiful and likes beauty". The influence is understood to be reciprocal: landscapes influence values, refining and fine-tuning them to particular conditions and circumstances, whilst traditional values shape resilient human attitudes and activities that conserve most valuable landscapes (Mallarach, 2008).

Over the centuries, religious guidance has been implemented for preserving natural features in the most diverse areas around the world, resulting in the development of cultural landscapes of spiritual significance in almost all ecosystems. These special landscapes are often located in areas that have been very relevant in the history of a particular faith. Depending on the culture, they sometimes also include the presence of religious buildings and structures, or not (Dudley et al,

2005; Vershuuren et al., 2010). Landscapes of religious significance can be related to a single religion or more than one, either overlapping, or in different combinations. For instance in Central Asia, Islam or Buddhism can be combined with old animistic or shamanistic traditions (Aitpaeva, 2013; Studley, 2010).

Sacred natural sites can be found, in different sizes and densities, and with differing levels of significance in most of the world's countries. It has been documented that sacred natural sites are encountered in all major ecosystems and that they encompass all the IUCN categories of protected areas (Verschuuren et al, 2007). It is also widely accepted that sacred sites constitute the oldest known form of nature conservation, and that in some countries, they encompass an area similar or greater to all the officially recognised protected areas combined. Management of sacred natural sites displays an amazing variety of forms, some of which have proved effective and resilient over centuries, adapting –or overcoming– to consecutive civilisations.

Historically, religious and spiritual values have been at the core of nature conservation, and in many countries still are. This is the main reason why they are considered so significant from the conservation viewpoint. Modern protected areas have often been established in landscapes which had been protected during centuries due to spiritual reasons, being considered holy, sacred, inviolable, numinised, etc. and/or managed following religious principles, like the case of harim in Islam or beyul in Tibetan Buddhism.

Landscapes of spiritual significance displaying a high conservation status after numerous centuries of proper management are eloquent proof of effectiveness, and can serve as inspiration. Specifically, they can provide guidance in terms of best practices in the contemporary conservation of an array of cultural landscapes around the world. For instance, monastic landscapes are result of best practices on natural resources management for some of the oldest self-sufficient communities that exist in Europe and the Middle East, following rules written down over 14 centuries years ago. Currently there is a revival of Christian monasticism in Eastern Europe and Russia, with numerous new foundations, most of them self-sufficient and respectful towards natural heritage values (Mallarach, 2012).

A different example, from Arabian Peninsula and Middle East is al hima, a type of protected area managed according with traditional knowledge and usually regulated by Islamic law. For centuries, the hima boasted equitable sharing of resources, social inclusion, sustainable use, representation for decision-making, management of scarce resources, rights of use, and conservation (Kilani et al, 2003). After years of decline and neglect, contemporary attempts to revitalise the hima as the

basis for natural protected area systems may have significant implications for nature conservation throughout the Islamic world (Llewellyn, 2003).

Currently, many significant landscapes for faiths are threatened in one way or another, and some of them are in dire risk. Religiously significant landscapes and also corridors, such as pilgrimage ways, are suffering a wide range of pressures, internal and external, such as illegal extraction of timber and wildlife, impacts from extractive industries' operations, encroachment by outsiders, disrespectful tourism, degradation of neighbouring environments, reduction of the availability of key resources for traditional peoples, decline of cultural and spiritual traditions, etc. In some cases, these landscapes have been integrated in legally declared protected areas, without recognition by government agencies of the traditional practices having sustained them, and of the spiritual and cultural significance of such landscapes for local populations or pilgrims. This has resulted in the violation of their traditional rights and has therefore created mistrust and animosity, which raise ethical issues and challenges in adequately managing such landscapes (Brown et al. 2005).

In highly secularised countries of Europe were religion has less social support, there is a growing trend on looking for silence, beauty and tranquillity as pre-requisits for having a more profound experience of nature, which for many people conveys a spiritual dimension. The British Areas of Outstanding Beauty as well as the Tranquillity Areas are two examples which have had rapid development in the United Kingdom, and several emulations in the European continent. This trend is having qualitative positive impacts in land planning, protected area planning and management. The organisation EUROPARC-Spain produced a manual for managers of protected areas to integrate the intangible heritage: cultural and spiritual values (Mallarach et al., 2012).

Since the Durban World Park Congress in 2003, there has been a growing recognition of the interrelation of the cultural and spiritual dimensions of nature in IUCN. The resolutions adopted by the IUCN General Assemblies of 2008 and 2012, including, among others: concerning sacred natural sites (Res. 4.038-2008); supporting custodian protocols and customary laws of sacred natural sites (Res. 147-2012); encouraging collaboration with faith organisations (Res. 009-2012); respecting, recognizing and supporting community conserved areas (Res. 094-2012); etc. provide solid and consistent mandates for IUCN deep and continue commitment to inclusive approaches.

Cultural and faith-based significance of nature has been included in the last version of the guidelines for applying IUCN's Protected Area Management Categories (Dudley, 2008). The IUCN's Specialist Group on Cultural and Spiritual Values

of Protected Areas, a network of experts of the World Commission on Protected Areas, and its Delos Initiative, in particular, provide a focus for IUCN work on these issues on mainstream faiths, especially in technologically developed countries They have actively working for more than one decade to promote and support the engagement of religious and spiritual organizations in conserving the natural and cultural diversity of the planet for current and future generations (Mallarach & Papayannis, 2007; Papayannis & Mallarach, 2010; Mallarach, Papayannis, Väisänen, 2012).

Together with UNESCO, IUCN produced the 2008 Best Practice Guidelines for managers of protected areas including sacred natural sites (Wild & McLeod, 2008). 'Sacred Natural Sites' is a catchword for natural places that are spiritually significant for peoples and communities. IUCN has also supported efforts by various organizations and stakeholders dealing with these dimensions from diverse approaches: landscapes, ecosystems, trans-boundary protected areas, world heritage sites management, etc.

Next, I would like to briefly present four examples of current initiatives of landscape conservation inspired by religious principles. The selection includes cases where existing threats and pressures are being prevented or counteracted on the basis of religious principles, involving the support from religious authorities, local population, conservation agencies or NGOs, and other significant stakeholders.

The Athonite Peninsula, Greece.

The Holy Mountain, or the Garden of the Holy Virgin, in north-eastern Greece, is the only existing Christian monastic republic of the world. For more than one millennium, the peninsula of ca. 330 Km2, with no land access has been inhabited by thousands of monks and hermits, becoming the chief standard bearer of Orthodox Christianity. In addition, because its outstanding values, it is a Natural and Cultural World Heritage Site, and is part of the European Natura 2000 network. The monastic population succeeded in preserving self-rule under Byzantium, the Ottoman Caliphate, within Greece, and now the within the European Union. The mountainous landscape, reaching more than 2000 m at the top of Mount Athos, is characterised by its complex topography, diverse vegetation, including numerous endemic species, preserved by the monastic orthodox communities. The spiritual authority of the Athos territory is the Ecumenical Patriarch Bartholomew I, one of the best known Christian environmental leaders (Bartholomew I, 2003). With some hundreds of settlements, and a growing monastic population, current challenges demand special landscape conservation actions, which have been agreed that will be defined in an integrated management plan for the entire monastic

landscape, based on religious principles, the management experience of the monastic communities, and scientific data and monitoring, which will require a good degree of coordination between the Athonite and the Greek authorities (Papayannis & Mallarach, 2009).

The Kailash Sacred Landscape Conservation Initiative

The Kailash Sacred Landscape Conservation Initiative is a significant collaborative effort of ICIMOD, UNEP, and regional partners in three countries, China, Nepal and India, initiated in 2009. The Initiative seeks to facilitate transboundary and ecosystem management approaches for biodiversity conservation and sustainable development through regional cooperation, based on religious principles. The Kailash Sacred Landscape includes a large area of the South-Western portion of the Tibetan Autonomous Region of China, and adjacent parts of North-Western Nepal, and Northern states of India. The geography of the greater Mt. Kailash area, famous since ancient times, represents a landscape significant for both cultural and religious reasons, to hundreds of millions of people, including Hindu, Buddhist, Bon Po, Jain, Sikh and other religious traditions, attracting thousands of pilgrims every year. In addition, this area includes the source of four of Asia's largest rivers: the Indus, the Brahmaputra, the Karnali and the Sutleg, which provide essential transboundary ecosystem goods and services vitally important within the greater Hindu Kush-Himalayan region, and beyond (ICIMOD, 2012).

The Covenant for the Jordan River

The Covenant for the Jordan River is a project of the Friends of The Earth Middle East, an organisation comprised of environmentalists from Israel, Palestine and Jordan, working cooperatively to conserve or restore their shared heritage. The Jordan River Valley is a landscape of outstanding ecological, cultural and religious importance, encompassing sites which are very relevant for Judaism, Christianity, and to a lesser extent, Islam. However, over the past 50 years, the Lower Jordan River has been destroyed: 96% of its historic flow has been diverted, and the remaining water is polluted with saline and effluent, and untreated sewage. The demise of the Jordan and the collapse of the valley's eco-system represent a failure of the most basic responsibility towards this landscape, the populations living along its banks, and the species whose habitats have been destroyed. Moreover, it cripples the growth of an economy based on tourism, and exacerbates political conflicts. The vision of the 'Covenant Project' is to have clean, living river flowing from the Sea of Galilee to the Dead Sea; in which the valley's plants and animals

have the water they need to thrive; in which the springs flow as they have for millennia; and in which the water extracted for human use is divided equitably between the nations that share the valley and the people who live here. As a first step, they promote the Jordan River Peace Park, which has already been endorsed by the mayors, religious authorities and communities on both sides of the River (Châtel, 2014).

Sumatran forest management.

New approaches are needed for biodiversity conservation has been acknowledged in Sumatra, Indonesia, the country with the largest Muslim population in the world, which has about 10% of the world's tropical rain forests, suffering a rapid rate of deforestation. Indonesia is one of the few majority Muslim countries that had been looking seriously at the environment issues through the Islamic prism. Through religious teaching, the three-year Darwin project, developed in 2009 in West Sumatra, promoted the importance of biodiversity conservation and its sustainable use to religious leaders who have largely been uninvolved in environmental issues. By engaging them and their followers in sustainable natural resource management approaches that are explicitly based on their religious principles (e.g. hima, harim, and ihya al-mawat), the project piloted a new conservation model that discouraged forest clearance and promoted the safeguarding of ecosystem services and biodiversity in a way that was both culturally appropriate (through the teachings of Islam) and replicable across most of Indonesia. The project also implemented faith-based educational programs, in collaboration with the provincial government. This further highlighted the potential of emulating such an approach throughout the rest of Indonesia and to the rest of the Muslim world (McKay, 2013).

Many other examples could be provided from both mainstream and indigenous peoples' faiths. During the last years the interest for alternative, efficient models of nature conservation has fostered the efforts of researchers in finding viable alternatives for nature conservation. Indigenous peoples, a minority of the world's population have however a large share of the bio-cultural diversity in the world. Their conservation practices are based either on their own spiritual traditions alone or combining them with value-systems from mainstream religions, depending on the cases and regions (Verschuuren et al, 2010).

Conclusions

Most landscapes and seascapes significant for faith communities would not exist without the deeply rooted cultural and spiritual values held by the people that have inhabited these places and who very often continue to care for them. Research of best practice examples based on spiritual values allows to stimulating lukewarm people or organisations as sources of inspiration.

Particular respect and recognition should be addressed to sites in protected areas that are sacred for indigenous peoples, local communities and religious minorities, which often lack the capacity and means to defend them. Similar respect should be shown to the spiritual needs and the potential contribution of new immigrants and the demands of multiculturalism, as happens in many large parts of the world.

In places where coexist multiple religions and/or spiritualities, or multiples branches of the same religion, it is necessary to recognise their different approaches to nature and ecosystems, as well as its implications for conservation, promoting the identification of common elements, so that interfaith collaboration can be encouraged to work for the conservation of the natural heritage based on solid spiritual principles.

All measures and initiatives concerning the natural, cultural and spiritual aspects of holy sites must respect the universal rights of people, as defined in a number of international conventions, and be grounded on sound and equitable participatory approach.

It is necessary to realise the full value of the heritage of traditional faith ethics and practices relating to nature conservation and thereby to involve with strong determination religious organisations and religious leaders to stop the losses of biodiversity on our landscapes, ecosystems and, finally, of our Planet. Current trends show that conservation organisations and agencies alone will not succeed. The highest values of humanity must be put at work and much broader and deeper alliances are needed.

Responsibility of stewardship (khilafa) at this moment of history, requires the preservation of the most endangered components of the Biosphere, for our common good, reminding that, according to the Islamic perspective, one of the Divine Qualities that conscious humans should emulate is The Preserver (Al-Hafith) (Foltz et al. 2003).

Now that numerous protected areas around the world are in trouble because of increasing pressures and cuts on governmental funds and declining private support, the resilient models of community conserved areas based on religious principles

appear, in many countries, to provide valid alternatives (Borrini-Feyerabend et al., 2004). Hence, it is time that those making policy and management decisions give more recognition to the inspirational values, healing powers, and holiness of natural areas, which make possible a stronger and deeper relation to nature of modern societies, and overcome the limits of the policies based only on material short-term and short-sighted profits. New religious inspired initiatives and alliances with strong religious organisations may be a crucial contribution to correct a materialistic approach for conservation that has proven to be limited, and thus to conserving our precious natural heritage for present and future generations.

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Kii Moutnain Range, Japan

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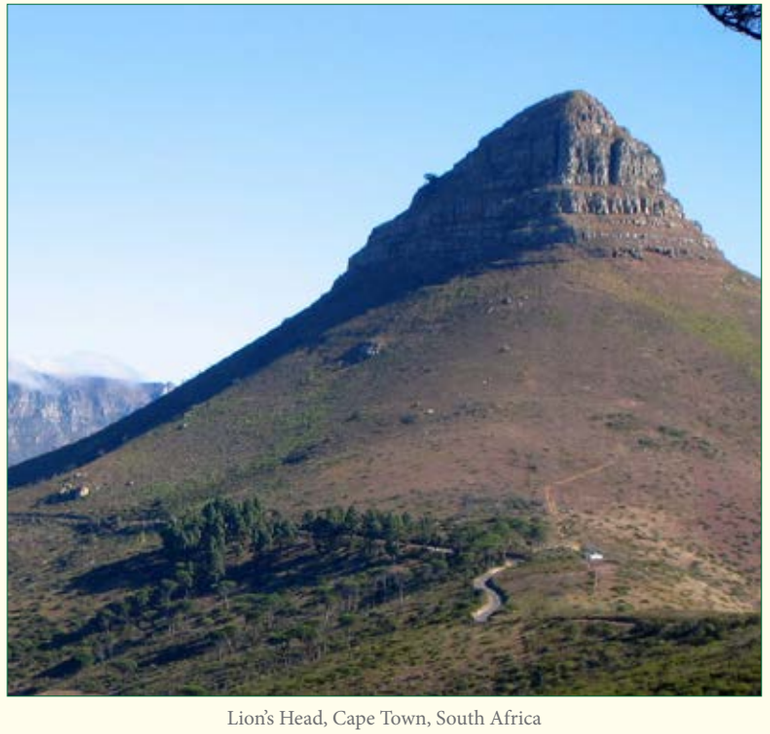

Lion's Head, Cape Town, South Africa

Mount AThos Monastery in forested landscape- Aghios Oros, Greece

Mt Ausangate SNS - Peru

Vers Mulay Abdassalam, Morocco

Mount Athos peak and monastery at the foot, Greece

THE SECOND INTERNATIONAL FORUM
OF THE QUR'ANIC BOTANIC GARDEN
ISLAMIC PERSPECTIVES ON ECOSYSTEM MANAGEMENT

Building a Framework of Collaboration
to Foster Ecosystem Management

ACCESSING KNOWLEDGE AND LESSONS LEARNED: A GLOBAL NETWORK OF SPECIALISTS. COMMISSION ON ECOSYSTEM MANAGEMENT- IUCN

Dr Angela Andrade

Dr Angela Andrade
Deputy Chair, Commission on Ecosystem Management.
International Union for Conservation of Nature (IUCN).
Email: aandrade@conservation.org

The Commission on Ecosystem Management of IUCN is one of the six scientific Commissions, and was established in 1996 by the Members Assembly in Montreal, Canada.

The Commission was established considering the increase recognition of the role that ecosystems and the services provided to human beings, allowing all forms of human livelihood. The wellbeing of people depends on the various goods and services, recognized among others by the Millennium Ecosystem Assessment in 2005, including food, fuel, clean water, protection of natural hazards, among others.

Ecosystems are under increasing pressure due to unsustainable use of natural resources, and other threats such as climate change, population growth and biodiversity loss, among others.

Commission Objectives and Structure:

The main purpose of CEM is to provide expert guidance on ecosystem approaches to the management of natural and modified landscapes and seascapes, in order to promote effective biodiversity conservation and build socio-ecological resilience to address global changes. CEM promotes the implementation of the Ecosystem Approach, as adopted by the CBD in 2000, in support of IUCN's mission on conservation of the world biological diversity and promoting sustainable development.

The Commission has to deal with the complexity of Ecosystems, considering social and ecological components and their interrelations; conflicting land uses and related institutions and regulations.

The Commission leads a network of more than 1000 scientists, experts and practitioners, from around the world, working on ecosystem management and across sectors and disciplines. During the last years, the numbers of members has increased considerably, in 2008 there were 400 members and in 2012, 800. Special attention is given to increase the involvement of young professionals.

Commission thematic groups:

The Commission has 23 thematic groups and task forces, responding to main topics and issues identified by members, and responding to the priorities established by the IUCN program. These thematic groups and task forces cover relevant thematic areas and ecosystems, representing the most outstanding areas of the world. Each group has a leader and a co-lead, who is tasked to develop a working plan and facilitate the function and fulfillment of main proposed actions. The most relevant thematic groups for the region are:

1. Ecosystems Redlist
2. Landscape Management
3. Climate Change Adaptation
4. Disaster Risk Reduction
5. Capacity Building for Ecosystem Management
6. Ecosystem Services
7. Ecosystems & Invasive Species
8. Ecosystems and the Private Sector

Regarding the thematic groups related to ecosystems or biomes, the most relevant for the region are:

9. Dry land Ecosystems
10. Ecosystems oasis
11. Wetland Ecosystems
12. Coastal Ecosystems Group
13. Mediterranean-type Ecosystems

The network includes 15 regional chairs, representing the IUCN regions and for some countries where there are a significant number of members, national focal points are established.

CEM Governance:

The Chair, supported by the Deputy Chair and the Steering Committee members, which represent the 5 continents of the world, and representatives of the Ecosystem Management Program of IUCN, leads the Commission. The Steering Committee meets twice a year in different areas of the world.

The Network of Volunteers and Experts of the Commission include more than 1.000 people. According with information available from May, 2014, the members of the West Asian Region are:

Jordan:	10
Iraq:	1
Iran:	5
Kuwait:	1
Syria:	1
Lebanon:	3
UAEmirates:	2
Saudi Arabia:	1

Members belong to the following thematic groups:

Ecosystem Restoration:	5
Climate Change Adaptation:	4
Landscape Management:	4
Ecosystem Services:	2
Red List:	1
Mediterranean Ecosystems:	5
Dryland Ecosystems:	3

Commission activities include actions such as:

1. Clearinghouse mechanisms
2. Workshops, conferences
3. Manuals, guidelines
4. Scientific publications
5. General advice: "serving the membership"
6. Policy inputs to international negotiations
7. Development of case studies that document
8. Best practices and knowledge.

CEM products

The most relevant products of CEM represent some of the main priorities included in the last 2 IUCN Programs, 2008-2012 and 2012-2016. These priorities are:

The Red List of Ecosystems: This initiative started in 2008, and since then it became one of the most relevant areas of the IUCN. It aims to develop a standardized system allowing objective, transparent and repeatable assessments of ecosystem risk and losses of functions and services. The main goal is to create the first RLE prior to 2020, contributing to the CBDs Aichi Biodiversity Target 5, related with reducing the rate of loss of natural habitats.

Ecosystem based Adaptation to Climate Change:

Climate Change Adaptation is becoming a very relevant component of the United Nation Convention on Climate Change. CEM has been promoting and working with the IUCN secretariat, since 2008, the application of the EsA to Climate Change. The Ecosystem Based Adaptation Concept was raised and later adopted by the CBD in 2009, known as Ecosystem based Approaches to Adaptation and Mitigation, EbA. EbA is an integrated framework to address the impacts of climate change and build resilience of communities and ecosystems. CEM has contributed with some publications on lessons learned based on case studies developed by CEM members and a proposal of principles and Guidelines to Ecosystem based Adaptation. CEM has promoted workshops and training courses on EbA in different areas of the world and aims to continue supporting the adaptation process for the benefit of human beings and help them to cope with climate change.

Disaster Risk Reduction:

CEM is committed with promoting the role of ecosystem management for reducing disaster risks due to natural disasters and those increased by climate change impacts.

This thematic group started in 2006 after the Tsunami, which affected areas of Sri Lanka and Thailand. CEM has been promoting the relevance of investing in sound management in order to reduce vulnerability to future disasters. Different publications related with Disaster Risk Reduction have been published since 2009 as well as the promotion of workshops and seminars. Relevant events include the Mexican Gulf Oil Spill in Washington and Merida.

Resilience of Ecosystems:

This is a Task Force, which aims at the consolidation and development of initiatives as Ecosystem Based Adaptation to Climate Change and Disaster Risk Reduction, including concepts such as resilience and transformative change. These thematic groups played a crucial role to support the work in resilience, such as the response to the Mexican Gulf oil spill.

CEM supports activities of EMP in islands and drylands. Also attention to other specific ecosystems (e.g. steppes, wetlands).

New groups focusing on aspects of ecosystem management and the private sector, as well as on urban ecosystems, are being established recently.

Considering the relevance of the problems that are facing countries located on dryland ecosystems, CEM encourages the strengthening of the network in these countries and call for the engagement of new members.

THE SECOND INTERNATIONAL FORUM
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ISLAMIC PERSPECTIVES ON ECOSYSTEM MANAGEMENT

Building a Framework of Collaboration
to Foster Ecosystem Management

SUSTAINABLE DEVELOPMENT IN ISLAM

Dr Iyad Abumoghli

Dr Iyad Abumoghli
Director and Regional Representative
United Nations Environment Programme (UNEP)
Regional Office for West Asia (ROWA)
P.O. Box 10880 Manama, Bahrain
Email: iyad.abumoghli@unep.org

Introduction:

A huge number of verses in Qura'n and several sayings of the Prophet Muhammad indicate the great importance that has been given to environmental concerns and the responsibility of man to the environment. The concept of sustainable development in Islam can be defined as "The balanced and simultaneous realization of consumer welfare, economic efficiency, attainment of social justice, and ecological balance in the framework of a evolutionary knowledge-based, socially interactive model defining the Shuratic process". The Shuratic process is the consultation or participatory ruling principle of Islam.

The over arching principle in the use of nature is derived from the prophetic declaration that states: "There shall be no damage and no infliction of damage". The right to benefit from the essential environmental elements and resources such as water, minerals, land, forests, fish and wildlife, arable soil, air and sunlight is in Islam, a right held in common by all members of society. Each individual is entitled to benefit from a common resource subject to establishing the degree of need, (needs have to be distinguished from wants) and the impact on the environment.

Earth is mentioned 61 times in the Qura'n. According to Islam, the universe has been created by Allah (God) with a specific purpose and for a limited time. The utilization of natural resources (ni'matullah - the gifts of Allah) is a sacred trust invested in mankind; he is a mere manager and not an owner, a beneficiary and not a disposer. Side by side, the Islamic nation has been termed as) ummatan

wasatan) the moderate nation in the Qur'an, a nation that avoids excesses in all things. Thus, Muslims in particular have to utilize the earth responsibly for their benefit, honestly maintain and preserve it, use it considerately and moderately, and pass it on to future generations in an excellent condition. This includes the appreciation of its beauty and handing it over in a way that realizes the worship of Allah.

The utilization of all natural resources – land, water, air, fire (energy), forests, oceans – are considered the right and the joint property of the entire humankind. Since Man is Khalifatullah (the vicegerent of Allah) on earth, he should take every precaution to ensure the interests and rights of others, and regard his mastery over his allotted piece of land as a joint ownership with the next generation.

Land Reclamation:

Prophet Muhammad said, "Whosoever brings dead land to life, for him is a reward in it, and whatever any creature seeking food eats of it shall be reckoned as charity from him". The Prophet in another occasion said, "There is no Muslim who plants a tree or sows a field for a human, bird, or animal eats from it, but it shall be reckoned as charity from him"; and, "If anyone plants a tree, no human nor any of the creatures of Allah will eat from it without it being reckoned as charity from him". This testifies the importance the Prophet in the early days of Islam has given to reclamation of land and the equal rights of all God's creatures to benefit from the resources of earth.

The Qura'n has also stressed the importance of water for agriculture and land reclamation. "It is "He" who sends out the winds, bringing advance news of "His" mercy. And "We" send down from heaven pure water so that it can bring a dead land to life and give drink to many of the animals and people "We" created, (Al Furqân 25:48-49). "A Sign for them is the dead land which "We" bring to life and from which "We" bring forth grain of which they eat. "We" place in it gardens of dates and grapes, and cause springs to gush out in it" (Yasin 36:33-34).

Natural Reserves

Wildlife and natural resources are protected under Shariah (Rules of Islam) by zoning around areas called "hima". In such places, industrial development, habitation, extensive grazing, are not allowed. The Prophet himself, followed by the Caliphs of Islam, established such "hima" zones as public property or common lands managed and protected by public authority for conservation of natural resources.

The First Biosphere Reserve in Islam:

"I declare Madina to be sacred throughout the area between its two mountain paths, so that leaves may not be eaten off except for fodder". The game in Madina is not to be molested not its fresh herbage cut". This declaration, fifteen centauries ago, is a testimony of the importance of biosphere reserves in Islam, Prophet Mohammad recognized that Abraham established the first reserve in Mecca.

Water Rights:

In the Shariah, there is a responsibility placed on upstream farms to be considerate of downstream users. A farm beside a stream is forbidden to monopolize its water. After withholding a reasonable amount of water for his crops, the farmer must release the rest to those downstream. Furthermore, if the water is insufficient for all of the farms along the stream, the needs of the older farms are to be satisfied before the newer farm is permitted to irrigate. This reflects the sustainable utilization of water based on its safe yield. According to jurists such as Malik and Ibn Qudamah, these same principles apply to the extraction of groundwater. A person has no right to adversely affect his neighbor's well by lowering the water table or polluting the aquifer.

Public Participation:

The Shura is taken here to mean the evolving decision making process at all levels of the Islamic society. It applies universally to the decision making on ecological matters as on political ones. Such a treatment of Shura is closer to its meaning in the Qur'an: "Wa amruhom shura baynahum" (Lead by consultation).

Balance of Natural Resources:

The Qur'ân advises us to maintain the balance as the world was created in balance. "We did not create heaven and earth and everything in between them as a game. If we had desired to have some amusement, "We" would have derived it from "Our" presence, but "We" did not do that", (Al-Anbiyâ 21:16-17). "He created man and taught him clear expression. The sun and the moon both run with precision. The stars and the trees bow down in prostration. He erected heaven and established the balance, so that you would not transgress the balance. Give just weight do not skimp the balance. "He" laid out the earth for all living creatures", (Ar Rahman 55:3-9).

Knowledge and Education:

The teachings of Islam have an ethical notion that guides Muslims to care about the environment; knowledge that helps them perfects their duties. "He taught Adam the names of all things. Then "He" arrayed them before and said, tell "Me" the names of these if you are telling the truth", (Al Baqarah 2:31). This verse describes how and why humankind was given the ability to know the names of creation. It is an important symbol of knowledge given only to the human race from among all the other creatures including angles.

Therefore, using religious education to convey the messages of Sustainable Development is an excellent tool as religious values are more accepted for Muslims than sophisticated jargon of new scientific terms.

Environment Protection

The rights to benefit from nature are linked to accountability and maintenance or conservation of the resource. The fundamental legal principle established by the Prophet Muhammad is that "The benefit of a thing is in return for the liability attached to it." Much environmental degradation is due to people's ignorance of what their Creator requires of them. People should be made to realize that the conservation of the environment is a religious duty demanded by God. God has said. "And do good as Allâh has been good to you. And do not seek to cause corruption in the earth. Allâh does not love the corrupters", (Al Qasas 28:77.)

Waste Generation:

Islam calls for the efficient use of natural resources and waste minimization. God says in Qura'n: "Eat and drink, but waste not by excess; "He" loves not the excessive", (Al-A'raf 7:31). "And do not follow the bidding of the excessive, who cause corruption in the earth and do not work good", (Ash-Shu'ara 26: 151-152). "And do not cause corruption in the earth, when it has been set in order", (Al-A'râf 7:56).

Importance of Water:

The word water occurs 66 times in the Qura'n which contains many such verses that speak of the life-giving properties of water: "Do you not see that Allah sends down water from the sky and then in the morning the earth is covered in green? Allah is All-Subtle, All-Aware", (Al Hajj 22:63). Water is the most important molecule in the life of an organism. That life originated from water is a fact mentioned in the Qura'n: "We made from water every living thing", (Al-Anbiya' 21:30). "Allah

created every animal from water. Some of them go on their bellies, some of them on two legs, and some on four. Allah creates whatever "He" wills. Allah has power over all things", (An Nur 24:45). Thus water is an important commodity that has to be conserved and sustainably utilized.

Water Pollution:

Water also plays another socio-religious function: cleaning of the body and clothes from all dirt, impurities, and purification so that mankind can be presentable at all times. Only after cleaning with pure (colorless, odorless and tasteless) water, Muslims are allowed to pray. One can only pray at a place that has been cleaned. In light of these facts, Islam stresses on preventing pollution of water resources. Urinating in water (discharging wastewater into water stream) and washing or having a bath in stagnant water are forbidden acts in Islam. The Prophet said: "No one should bathe in still water, when he is unclean".

Efficient use and Conservation of water:

The teachings of Prophet Muhammad emphasize the proper use of water without wasting it. The Prophet said: "Don't waste water even if you are on a running river". He also said: "Whoever increases (more than three), he does injustice and wrong".

Sustainable Use of Biodiversity

God has created biodiversity for the benefit of mankind who is requested to protect it from degradation and pollution and is responsible for its sustainable use. God says in the Qura'n: "We sent down a measured amount of water from heaven and lodged it firmly in the earth; and "We" are able to remove it. By means of it "We" produce gardens of dates and grapes for you, in which there are many fruits for you and from which you eat, and a tree springing forth from Mount Sinai yielding oil and a seasoning to those who eat. And there is certainly a lesson for you in your livestock. "We" give you to drink from what is in their bellies and there are many ways in which you benefit from them, and some of them you eat; and you are conveyed on them and on ships as well", (Al Muminun 23:18-22). "He Who has spread out the earth for you and threaded roads for you therein and has sent down water from the sky, with it "We" brought forth diverse kinds of vegetation. Eat and pasture your cattle; in this are signs for men endued with understanding".

Air Pollution:

"It is Allâh who sends the winds which raise the clouds which "We" then drive to a dead land and by them bring the earth to life after it was dead. That is how the resurrection will be", (Al Fatir 35:9). The Prophet discouraged or prohibited activities that result in offensive smells and odors, from taking place in certain public places. He said: "He who eats garlic or onion should stay away from us". The period that one should stay away is limited to the duration of the smell. By analogy, anything that pollutes the air and is detrimental to the health should be prohibited.

Sustainable Forestry:

Islamic legislation on the preservation of trees and plants finds its roots in Qura'nic teachings of Prophet. They include the following: "Whoever plants a tree and looks after it with care, until it matures and becomes productive, will be rewarded in the Hereafter" and "If anyone plants a tree or sows a field and men, beasts or birds eat from it, he should consider it as a charity on his part.

He is also reported to have encouraged tree planting as a constructive practice, saying that even if one hour remained before the final hour and one has a palm-shoot in his hand, he should plant it. Even at times of war, Muslim leaders, such as Abu Baker, advised their troops not to chop down trees and destroy agriculture or kill an animal.

Poverty Alleviation

There are a number of terms describing poverty and poor people in Islam. Faqir (poorest of the poor) and Miskin (whose legitimate needs exceed his means]) are the two basic classifications of poor in Islam. The Islamic way of poverty alleviation focuses on developing human resource and providing relevant job opportunity. The institutions identified for financial assistance to the poor are assistance (kifalah) by: the nearest kin; the neighbors under neighborhood rights; others in the form of mandatory charity like (Zakat), obligatory contribution; and through temporary and permanent endowments. Moreover, an Islamic State is bound to provide sustenance to its citizens irrespective of their religion. The State meets this responsibility by collection of Zakat, other emergent charities and raising taxes. The extent of such relief to the poor under Islam cannot be disputed. Zakât and Bait-ul-Mal (public treasury) are the two institutions, which, if used properly, can address the problem of poverty to a great extent. The institution of Bait-ul-Mal has tremendous potential for reaching the poor and helping them to escape

poverty. Other systems like "Mudaraba" (partnership in labor and capital) and sharing profits "Musharaka" (partnership in capital and sharing profits) are Public Private Partnership tools used in Islam to alleviate poverty by providing income-generating activities for the poor in a partnership scheme.

Good Governance:

The Qur'anic term "fasad" includes destruction of both the environment as well as man's own destruction. What Muslims understand by development is providing self-esteem, freedom and physical security to every individual with a certain minimum quota of food, clothing, shelter, education and health facilities. Representing the concept of Good Governance, God said in the Qura'n: "Do not do mischief on earth after it has been set in order", (7:85). Corruption is a serious matter in Islam where it represents the mismanagement and destruction of the balanced system God created. The Prophet has requested Justice, as part of a good governance system, in several occasions: "If you rule people, rule in justice".

Cultural and Ethnic Values:

The spiritual, racial, cultural and ethnic diversity of the human family should be recognized as being the will of the Almighty and as such, as something to be cherished rather than as a cause for hostility. God says in the Qura'n: "We created you peoples and tribes to meet, the best of you to God is the most devoted to God". Devotion here means not only paying religious dues, but also responding to all teachings of Islam.

Environment Impact Assessment and Mitigation

The interests of the Islamic nation and the society as a whole take priority over the interests of individuals and various groups when they cannot be reconciled. Some juristic principles of Islamic law are: "Priority is given to preserving the universal interest over particular interests", and "The general welfare takes priority over individual welfare". From this basis is derived the principle that: "A private injury is accepted to avert a general injury to the public". Similarly, sacrificing private interest for the purpose of achieving and protecting the common interest of the public is related to the juristic principles that "The lesser of two evils shall be chosen". Severe damage shall be removed by means of lighter damage". If one of two opposing detriments is unavoidable, the more injurious is averted by the commission of the less injurious". Social goods or interests are to be assessed according to their importance and urgency. The above represent the basic principles of Environmental Impact Assessment and mitigation of adverse impacts by selecting the less

harmful option if an action is unavoidable. In Islam, necessities (daruriyat) which are absolutely indispensable needs to preserve religion, life, reason, and property; and needs (hajiyat) which if unfulfilled will lead to real hardship and distress; and supplementary benefits (tahsiniyat) which involve the refinement of an option are more or less the same concepts of EIA.

Responsibilities toward Disabled and Poor (Unprivileged Communities)

Consideration is to be given to the abilities of various groups to secure their welfare. The governing authorities are obliged to protect and care for the disadvantaged and less influential groups in accordance with the juristic principles that: "The averting of harm from the poor takes priority over the averting of harm from the wealthy".

Sustainable Development Institutions:

Among the prerequisites for effective conservation of the natural environment are appropriate institutional arrangements. A number of resource management institutions have been created in Islam including; Hisbah, Haram, Hema, Waqf, and Ihya.

1. Land reclamation or revival (ihya'): Normally, in Islamic law, any person who brings life to un-owned land by undertaking its cultivation or reclamation or otherwise putting it to beneficial use acquires it as his private property. Only those actions that bring new life to the land confer ownership. Ihya' gives people a powerful incentive to invest in the sustainable use of the land to provide for their welfare and the welfare of their families and descendents.
2. Reservs: Lands in which development would be injurious to the general welfare are not acquired through ihya'. The governing authorities have the right and obligation to prevent the development of vacant land wherever such development would result in environmental damage, or remove an indispensable resource from public access. This includes all lands which are set aside as reserves (hima) for the general good.
3. Zoning and land use planning (haram): Involves protecting water resources and other utilities, communal pasturelands and woodlands pertaining to villages, and lands containing resources that are indispensable to the welfare of the community.
4. Public Lands (Iqta'): The governing authorities have the right to make grants (iqta') of un-owned land for purposes of reclamation such as agriculture, horticulture, building, and other kinds of development, so as to channel such developments to suitable locations and away from unsuitable locations.

5. Leased Lands (ijarah): The governing authorities have the right to institute the lease (ijarah) of state- owned lands or to grant their use or reclamation (iqta' manfa'at al-ard or iqta' al- istighlal) and to specify the kinds of improvements to be undertaken or the crops to be grown, and the management practices and techniques of fanning, building, and so forth, to be employed.
6. Sustainable Development (Charitable) endowments (waqf): Islam encourages individual Muslims to participate in the conservation and sustainable development of natural resources through various gifts, inheritance, and loans. The most important institution of Islamic law in this regard is the charitable endowment (waqf), which constitutes the major avenue for private contribution to the public good. The waqf may take the form of a land trust dedicated in perpetuity to charitable purposes such as agricultural and range research, wildlife propagation and habitat development, a village woodlot, or a public cistern, well, or garden; or it may take the form of a fund or endowment for the financing of such projects. The governing authorities may set provisions and standards for such waqf lands and funds, and for the qualifications of their managers, so that the benevolent objectives of such projects may be effectively fulfilled.

The Mandate of the Governing Authorities:

The primary duty of the ruler and his assistants, whether they are administrative, municipal, or judicial authorities, is to secure the common welfare and to avert and eliminate injuries to the society as a whole. This includes protection and conservation of the environment and natural resources. Historically, many of the responsibilities of environmental protection and conservation have come under the jurisdiction of the office of the hisbah, a governmental agency that was charged specifically with the establishment of good and eradication of harms. The muhtasib, who headed this office, was required to be a jurist thoroughly familiar with the rulings of Islamic law that pertained to his position. He was responsible for the inspection of markets, roads, buildings, watercourses, reserves (hima) and so forth. Among his duties were supervision and enforcement of regulations and standards pertaining to safety, hygiene, and cleanliness; the removal and disposal of wastes and pollutants; the prevention and elimination of hazards and nuisances; the protection of reserves (hima) from violation and trespass; and the prevention of abuse and treatment of animals. He was responsible for assessing damages and imposing fines and other penalties. In addition, he had wide discretionary authority to take necessary measures to ensure the public welfare.

The Mandate of the Individual:

The protection, conservation, and development of the environment and natural resources is a mandatory religious duty to which every Muslim should be committed. This commitment emanates from the individual's responsibility before God to protect himself and his community. God has said, "Do good, even as God has done you good, and do not pursue corruption in the earth. God does not love corrupters".

Social Responsibility

The ethical system that governs socio-economic policies in Islam is hinged around four main principles. They are: 1) Unity (Tawhid) in which individual actions must conform to an integrated whole; 2) Equilibrium (Al'adl wal ihsan) in which individuals have the freedom to act, but must do so with bearing the general well-being of the present and future generations; 3) Free will (Ikhtiyar) by which individual freedom is guided by a broader framework of duty to community or societ; and 4) Responsibility (Fardh) by which individuals and society have the responsibility to use and dispose of possessions and wealth in a responsible way. The above ensure that individuals and communities have a social responsibility towards others. To institutionalize the social responsibility, Islam has created zakat, sadaqa, and the inheritance system. The Baitul-mal (treasury), as a State institution would then redistribute the collection of zakat to two categories of poor, the fuqara (poor from Muslim communities) and masakin (poor from non-Muslim societies).

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THE SECOND INTERNATIONAL FORUM
OF THE QUR'ANIC BOTANIC GARDEN
ISLAMIC PERSPECTIVES ON ECOSYSTEM MANAGEMENT

BIODIVERSITY CONSERVATION: Building a Framework of Collaboration to Foster Ecosystem Management

A WHOLE-SYSTEMS APPROACH AT THE ROYAL BOTANIC GARDEN

HRH Princess Basma bint Ali

HRH Princess Basma bint Ali
Founder, Royal Botanic Garden
Hashemite Kingdom of Jordan
Email: basmaali@royalbotanicgarden.org
www.royalbotanicgarden.org

Abstract

The Royal Botanic Garden (RBG) was founded as a non-governmental, non-profit entity in 2005 to conserve the flora and biodiversity of Jordan by propagating and displaying native plants, rehabilitating habitats at the whole-systems level, conducting research, demonstrating sustainable practices, working with the local communities and sharing information.

The RBG envisions a future where there is no longer a need for environmental conservation and where the interdependency between people, plants and ecosystems is well understood such that people are assured of a sustainable lifestyle which ensures a life of dignity.

Scientific research is the backbone of the RBG's work. Thus major efforts had to be conducted to fill in the research gaps on our native plants. One important issue was compiling Jordan's National RED list of Plants and developing a national strategy for the conservation of the important socio-economic plants of Jordan. A seed bank is currently being established focusing on the conservation of Jordan's

native plant species. In addition the RBG has a herbarium, and a virtual herbarium. The latter is accessible by all and provides high-resolution scans of specimens which can be uploaded by users at www.nationalvirtualherbarium.org, It is the region's first online herbarium.

Scientific research underpins all aspects of work at RBG. From this platform the RBG has placed man as an integral part in the sustainable conservation formula and as such has developed the Community-Based Rangeland Rehabilitation (CBRR) program which integrates herd management practices with rangeland management such that pastoralists become an effective conservation element. They are taught good practices in sheep and goat herd management which results in higher incomes, while improving family and herd health, in addition to promoting grazing practices that are less destructive to the environment. The CBRR program is reviving handicraft and natural food production so as to achieve a more resilient future for all.

Sustainable living is an important component of the RBG's work. Demonstrations of earth architecture, alternative energy, rainwater harvesting, permaculture and other replicable ways to promote integrated sustainable self-reliance are all integral parts of the botanic garden's message.

In the course of its work, the RBG is also helping Jordan's Ministry of Environment reach certain goals in its biodiversity strategy and action plan, to meet national commitments to international treaties such as the Convention on Biological Diversity.

Introduction

The major goal of the Royal Botanic Garden of Jordan is to secure the future through the conservation of native plant diversity.

Plants are at the basis of all human activity. We depend on plants for food, clothing and shelter, and we rely on them to hold our soil in place, provide habitats for wildlife, and regulate the water cycle.

Jordan is in the Fertile Crescent. It is in the 4th most important area for Crop Wild Relatives, but also the 2nd water-poorest country in the world. Sadly, our habitats are under threat. Wild plants and habitats are fast disappearing due to urbanization, tourism activities, overgrazing, expansion of agricultural land, and lack of attention to natural heritage and ecosystem services.

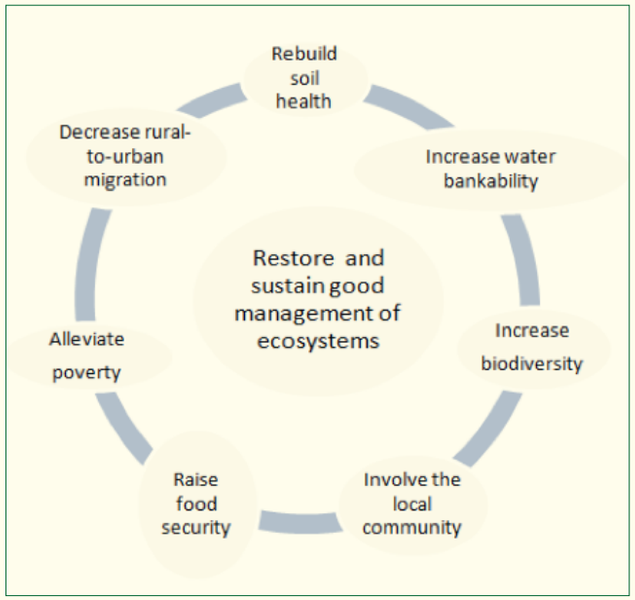
There is an urgent need, in Jordan and elsewhere, to safeguard our plants and biodiversity. It is imperative that we take care of precious plant resources and ensure that they remain available for future generations.

VISION

The Royal Botanic Garden envisions a future where there is no longer a need for environmental conservation… A future where the interdependency between people, plants and ecosystems is well understood… A future where all people are assured of a dignified, sustainable life.

To achieve this vision, concrete steps must be taken, methodically, in three key areas: scientific research which is the basis of all our work and traditional knowledge where we are keeping the dialogue of knowledge, which is a very valuable resource, alive between local communities and us so we can pass it on to the community at large through our education and community development and sustainable living component. The sum of our efforts in each of these areas will enable us to have a long-term, beneficial impact at the whole-systems level. If we leave out any element, the results will be far less effective and less durable.

The Royal Botanic Garden is therefore working multi-dimensionally to conduct research, propagate and display native plants, rehabilitate habitats, demonstrate sustainable practices and share information, in partnership with the community.



Concepts 1: Rehabilitating Ecosystems at the whole-systems level

Taking the Islamic perspective each aspect of the ecosystem plays an important part in the intricate balance. Therefore, RBG is starting by restoring our soils which will increase the water bankability, thus allowing for increase in biomass and that will then lead to biodiversity increase, which will then help local communities develop agribusinesses that are sustainable.

Hence, Efforts must be made at every level to restore habitats and ecosystems. Using an approach that includes local community participation, we are able to encourage greater self-sufficiency at the family level, alleviate poverty, and curb the flow of rural-to-urban migration. This approach is also the way to work towards mitigating climate change and achieving Millennium Development Goals 1 and 7 as well as the AICHI targets.

The Royal Botanic Garden is currently focusing its attention on five major habitats of Jordan. In researching the plant palettes needed to re-create these habitats on the RBG site, the main steps are: archival research to find out which species were present during the past century; fieldwork to determine whether or not specimens still exist in situ; GPS mapping to facilitate future collection and propagation; gathering of seeds or cuttings for propagation, where possible and appropriate; collecting herbarium samples and photographs for research and design purposes.

Preliminary research revealed huge gaps in information and resources, as most early studies of Jordanian plants had been focused at the species level, without consideration to habitats. Also, much of the existing data was scattered among a number of botanic gardens, herbaria and universities outside the country.

The RBG began to fill in the gaps through: workshops with all Jordanian stakeholders to develop national criteria for the identification of native plant species and prioritization of plants for conservation; data gap analyses; ground truthing and information-gathering trips to institutions abroad; data sorting; plant prioritization; preparation of an annotated flora checklist; preparation of the Jordan Plant Red List (Vol. 1); and development of propagation protocols for native plants.

Concept 2: Local Community Partnership

Local community partnership is the key to successful conservation. The RBG consults and cooperates with the community in its work through initiatives like the Community-Based Rangeland Rehabilitation programme, and teaches good practices and sustainable living skills to pastoralists, farmers and families. As a result, local employment rates are on the rise, individual and regional capacities are being built, and value-added products and markets are being developed. The results are already measurable and sustainable.

Community-based rangeland rehabilitation programme

Rangeland throughout Jordan and the region is severely overgrazed and steadily shrinking. Since it is well-documented in other parts of the world that removing grazing from traditionally gazed landscapes often has a negative impact on species diversity, the RBG was interested in adopting a different, collaborative approach.

When the RBG first began its work, local herders would cut the fence surrounding the botanic garden so that herds could graze inside the site at night or in the early morning. This was a huge problem, as the RBG needed to be able to restore plant cover, conduct vegetation surveys and calculate biomass estimates without random interference from animals.

After consultative meetings with community representatives, the RBG created the Community-Based Rangeland Rehabilitation (CBRR) programme in 2007. With local participation, a plan was devised to supply replacement forage to livestock owners, in return from them withdrawing their flocks, and allow grazing inside

the Garden under managed conditions. The CBRR team collaborated closely with herders, gave practical trainings to the community, and began to establish environmentally friendly community income generating projects. The CBRR initiative was so well received that livestock owners who once grazed the land down to bare earth are now policing themselves and others, to protect the benefits they are reaping from the CBRR and the rapidly reviving ecosystem. Through the CBRR, 42 families and about 5000 head of sheep and goats are currently benefiting from better herd health and management, regulated grazing, and new income generating opportunities. A marked gain in biodiversity was noted, with biomass in the Garden rising from 50 to over 100 tons within four years, and wild plant species recorded in the site increasing from 436 to 580 species.

It is clear that this participatory approach and positive socioeconomic effects for the local community should be part of any effort to restore ecosystems, and can be replicated in many locations.

The CBRR team has also started the task of collecting local knowledge from community elders, so that important traditional information, such as uses of wild plants for healing, is not lost.

Socio-economically important plants

Another of the RBG's goals is to promote the use and, in some cases, the re-discovery of native plants that have socioeconomic uses. Some plants can be eaten or used as flavourings or natural medicines, while others may produce oil, dyes or fibre. Of particular interest are the Crop Wild Relatives of wheat, barley, beans and other food plants, which are native to Jordan. As a natural heritage, all socio-economically important plants must all be studied, utilized and/or conserved for future research.

Rbg site development

Although the Royal Botanic Garden is still under development, it is expected that Phase I will open to the public in the relatively near future. Since the RBG's scientific and community programmes are now well established, it is time to focus more on visitor facilities, display gardens, education and ecotourism elements.

The developments of the plans are directly based on the Islamic Sacred Science which underpins all of the RBG's work and ethic. This has been based on the quadrivium of , numbers, music, astronomy and geometry. The gardens will be distributed among various zones with specific themes such as numbers in nature. The interpretation is vital because the RBG intends to invoke a sense of respect

towards our traditions in a subtle yet beautiful way such that the visitor can stand in awe of Gods creations.

Plans for the 1,800-dunum site include: a gateway building (ticketing, coffee bar, gift shop), global context building (visitor orientation), visitor centre (exhibition space, auditorium, prayer room), forestry museum, hardscaping (pathways, hiking trails, scenic lookouts), interpretive signage, interactive exhibits, café, refreshment stands, waterfront area (floating café, dock, lifeguard station) and an ecolodge, among other things.

Display gardens will follow specific themes while highlighting the practicality of using native xeriscape plants, which are best adapted to Jordan's arid climate. Five complete Jordanian habitats are being re-created on the site, and an Islamic garden will feature plants and designs from different periods of history.

Site Doing

Rather than sightseeing, the RBG intends to promote site doing. When people are actively engaged in fun activities outdoors, it is easier for them to connect, or re-connect, with nature.

Activities at the RBG may include hiking, rock climbing, rowing, solar cooking, medicinal plant picking, mushroom workshops, festivals, farmers' markets, etc. The visitor experience will be extended by narratives on the origins of the tulip, the story of the olive tree, or revelation of the secret ingredient in sahlab. Changes in the seasons will also provide ample opportunities for new experiences at the Garden.

The way forward

As the Royal Botanic Garden pursues its biodiversity research and conservation objectives, it is looking forward to opening its doors to the public and becoming a much-visited venue for recreation, environmental education and ecotourism.

The Garden's opening will expand economic opportunities in Jordan. Currently, 25 people are on the RBG staff, 135 direct job placements have been created, and indirect jobs have been generated for 200 families. As the Garden develops, 100s more people will be employed. The projections for prosperity are unlimited.

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CONSERVATION, ECOLOGICAL RESTORATION AND PARTICIPATION – THE CHANGING ROLES OF BOTANIC GARDENS

Dr Sara Oldfield

Dr Sara Oldfield
Secretary General, Botanic Garden Conservation International BGCI
United Kingdom
Email: sara.oldfield@bgci.org

Botanic gardens have evolved over the centuries in response to the changing needs of society. Currently, biodiversity loss is one of the major issues facing humanity. Natural habitats continue to be degraded and destroyed and at least 25 percent of plant species are threatened with extinction in the wild. There is an urgent need for more conservation action focussing on plants. The global network of botanic gardens has important roles to play in responding to global biodiversity policy and taking coordinated action in plant conservation and ecological restoration. The development of botanic gardens in the League of Arab States is of major significance in helping to tackle the loss of plant diversity both in the region and internationally.

In 2013, the Millennium Alliance for Humanity and the Biosphere developed a Consensus Statement by Global Scientists stating that, "Unless decisive countermeasures are put into place immediately, climate change, loss of ecological diversity, extinctions, environmental contamination, human population growth and overconsumption of resources will degrade our quality of life within a few decades.[1] "

[1] http://mahb.stanford.edu/consensus-statement-from-global-scientists/

In responding to global environmental issues, communication with all sectors of society is increasingly important. Botanic gardens are specialised institutions that are generally public-facing and provide an interface between botanical science, horticulture and the public. Collectively they provide a respected voice in biodiversity conservation and champion the cause of plants. The now well-established role of botanic gardens in the conservation of plant diversity has developed over the past fifty years. Collectively botanic gardens now hold material of around one-third of all wild species in documented collections of great value for ex situ conservation , research, education and increasingly for ecological restoration.

The botanic garden community, co-ordinated by Botanic Gardens Conservation International (BGCI), has played a leading role in the development of the Global Strategy for Plant Conservation (GSPC) of the Convention on Biological Diversity (CBD). The GSPC, with its 16 Targets, was unanimously agreed by all CBD parties in 2002 and was updated in 2010 to reflect the challenges associated with global climate change. Botanic gardens worldwide are actively involved in implementing the GSPC which in turn supports the 20 Aichi Targets of the CBD's Strategic Plan for Biodiversity.

BGCI works closely with the CBD Secretariat in support of the promotion and implementation of the GSP. In 2014, BGCI has undertaken a mid-term review of the Strategy on behalf of the CBD Secretariat.[2] Information for the review has largely been provided by members of the Global Partnership for Plant Conservation (GPPC). This coaittion of organisations is mandated to support the GSPC at an international level. Information for the mid-term review has also been compiled from national reports to the CBD and National Biodiversity Strategy and Action Plans.

Overall global progress toward the GSPC Targets has been variable. The first two targets are very important as they provide baseline information, GSPC Target 1 on plant names and distribution and GSPC Target 2 on the conservation status of species. GSPC Target 2, calls for a preliminary assessment of the conservation status of all known plant species by 2020. This information is urgently needed to demonstrate more accurately the scale of the global plant conservation problem and to help prioritise action. With estimates suggesting that around one-third of all plant species are threatened with extinction and with the impact of climate change increasing species extinction risk, reliable information is needed on which the species are under threat. The IUCN Red List of Threatened Species™ is recognized as the most comprehensive and objective approach for evaluating the extinction risk of species globally. Unfortunately however, by the end of 2013, only

[2] An information paper on this is available at http://www.cbd.int/doc/meetings/sbstta/sbstta-18/information/sbstta-18-inf-10-en.pdf

6% of plant species had been assessed at the global level using the IUCN Red List Categories and Criteria.

BGCI is contributing to Target 2 of the GSPC by undertaking Red List assessments for woody plant species. BGCI provides the Secretariat for the IUCN SSC Global Tree Specialist Group which aims to assess the conservation status of all woody plants by 2020 as a contribution to the IUCN Red List and to support global monitoring of forest biodiversity. This is a very ambitious aim but is achievable given advances in bioinformatics. As part of the overall tree assessment, a PhD student is looking at the extinction risk of timber species & likely impact on human wellbeing resulting from the loss of these valuable species. Overall timber trees contribute $468 billion to the global economy annually and timber species also make a huge contribution to carbon storage, nutrient & water cycling, climate regulation, habitat provision and cultural services.

BGCI and the Royal Botanic Gardens, Kew are the two members of the IUCN Red List Partnership with a focus on plants. As an interim measure to support the achievement of Target 2, RBG Kew has produced a list of plant conservation assessments by compiling existing datasets, including the IUCN Red List, information from national red lists and preliminary assessments published elsewhere, for example reports published by BGCI on the conservation status of woody plants. The interim list of plant assessments includes 58,494 unique plant assessments (approx. 16% of all plants). Of these, 43% plants assessed are categorised as 'threatened' with extinction, and more than half of the assessments are at regional/national level.

As noted above, GSPC Target 2 is very important as a baseline for measuring progress in plant conservation. Botanic gardens are frequently involved in conserving plants in their natural habitats, with for example a recent survey finding that over 220 institutions in North America own and manage natural areas, ranging in size from under one hectare to over 5,600 hectares. Over half of these areas are known habitat for threatened plant species. More broadly, many botanic gardens are involved in the documentation of important areas of high biological diversity as a basis for habitat protection. In these ways botanic gardens are helping to support Target 7 of the GSPC which calls for at least 75 percent of known threatened plants to be conserved in situ. The mid-term review of the GSPC notes that it is very difficult to measure overall progress towards Target 7 because of the lack of data on globally threatened plant species and the lack of plant inventories for protected areas.

In contrast monitoring progress towards GSPC Target 8 is relatively straightforward as this relates to ex situ conservation. Carrying out this form of conservation is an extremely important role for botanic gardens that keep documented collections of rare and threatened plants in living collections and seedbanks. One of the defining characteristics of botanic gardens is the careful documentation and recording of the plants in their collections. Combining plant records from individual gardens, BGCI's online PlantSearch database currently includes over 1.2 million records, relating to more than 387,500 taxa provided by over 1,000 botanic gardens. A recent assessment by BGCI has identified 10,100 globally threatened species (using a combination of both the 1997 and 2013 IUCN Red Lists) in botanic garden collections. This provides a measure of progress towards Target 8.

GSPC Target 8 also calls for plants to be available for recovery programmes so that botanic gardens can use their stored plant material of known origin to restore damaged ecosystems. This is a major challenge for botanic gardens but one that is now being addressed collectively. The Ecological Restoration Alliance of botanic gardens, facilitated by BGCI, (see www.erabg.org) was established in 2012 and now has 16 botanic garden members. The Royal Botanic Garden, Jordan is playing a lead role within the Alliance and will host a meeting in April 2015. The work of the Royal Botanic Garden in community-based rangeland rehabilitation provides an excellent example of how botanic gardens can engage with their local communities to support ecological restoration and improved livelihoods.

Other targets of the GSPC that botanic gardens are supporting relate to sustainable production, use and trade of wild plants. They also relate to developing practical protocols, sharing techniques, networking, training, education and building public awareness. The overall plant conservation and restoration agenda is hugely ambitious and one that needs to be promoted more widely. This is such an important role for botanic gardens. Finding new ways to communicate the importance of plants and the need for conservation of plant diversity is vital. Botanic gardens need to work together, through regional and global networking, to find ways to reach new and increasingly-urbanised audiences, involve a wider range of people in practical conservation and restoration action and share successful experiences.

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Building a Framework of Collaboration to Foster Ecosystem Management

THE QUR'ANIC BOTANIC GARDEN; A GATE FOR AN EFFICIENT FRAMEWORK, GARDEN'S CONCEPT

Ms. Fatima bint Saleh Al-Khulaifi

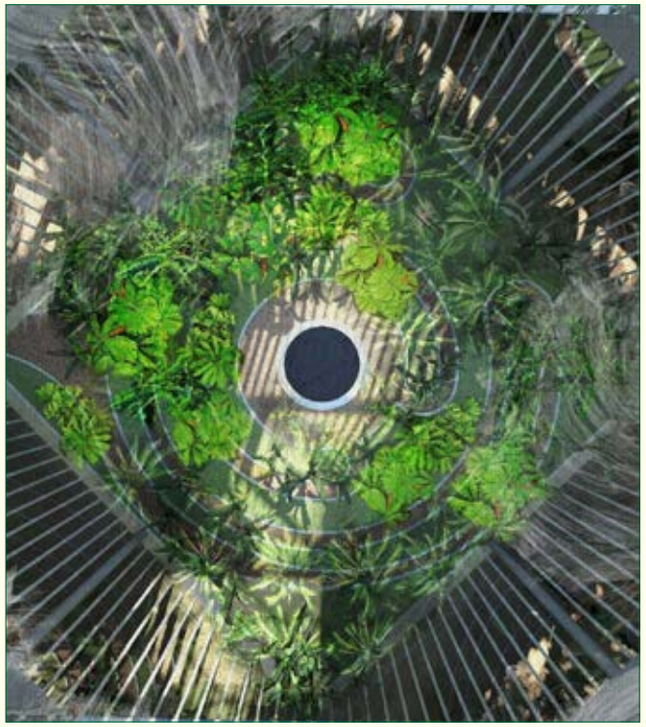
حديقة القرآن النباتية
QUR'ANIC BOTANIC GARDEN
عضو في مؤسسة قطر
Member of Qatar Foundation

Ms. Fatima bint Saleh Al-Khulaifi
Project Manager, Qur'anic Botanic Garden
Qatar Foundation for Education, Science and Community Development,
Doha, Qatar
Email: fsalkhulaifi@qf.org.qa

The Qur'anic Botanic Garden comprises all the plant species mentioned in the Holy Qur'an and those in the Hadith and Sunnah, (Sayings and the traditions of the Prophet Muhammad (PBUH)) adopted from the recognized and authentic sources of Sunnah (Sahih al-Sunnah). The Qur'anic Botanic Garden exhibits the botanic and environmental terms mentioned in the Holy Qur'an and Hadith while providing insight behind their mention in the Holy Qur'an as well as explain their composition and application according to modern science.

The Qur'anic Botanic Garden's concept was introduced by the UNESCO office in Doha and is in line with the Vision and Mission of the Qatar Foundation's role in fostering science, culture and education. The Garden has a vision of promoting the appreciation and preserving of the natural, cultural and spiritual heritage of the Islamic and Arabic nations in a global context by providing unique and world class opportunities for discovering and learning. The Garden will also emphasize the support of awareness with the different environmental fields, as well as the integration within the modern scientific achievements. It will also open windows for enhancing the cooperation and coordination among different stakeholders in these fields.

The activities of the Qur'anic Botanic Garden are organized to conform to the vision and objective of the Qatar Foundation and Qatar National Vision 2030 as well as the International Botanic Gardens, sustainable environment, learning & education and preservation of the culture & heritage.



Plants from Qur'anic Botanic Garden in a innovative design shapes planned in permanent garden site.

Plants of the Qur'anic Botanic Garden; Numbers & Categories

Numbers

The Qur'anic Botanic Garden includes about 60 plant species. Of those, 20 are mentioned in the Qur'an, including Al-Zaqqum and Al-Daria, both of which are plants that grow in hell; May Allah spare you and us. Since Al-Zaqqum is not a common name for a particular plant, we decided not to include entries for the species scientists claim to be its earthly counterparts. As for Al-Daria, it refers to a plant known to Arabs as Al-Shubruq, which is called Al-Daria when it dries up. It

is also important to note that some plant names actually refer to families of plants such as Al-Yaqtin, which refers to several types of gourds.

The Prophetic tradition makes reference to 51 plants, including 38 that do not occur in the Qur'an and 13 that occur in both. In addition to the plants of the hell, namely Al-Zaqqum and Al-Daria, the Qur'an mentions five plants that do not occur in the Sunnah. These are fig trees, gourds, Banana, lentil and ginger.

Categories

The plants in the Qur'anic Botanic Garden fall into three categories according to their natural habitats. These are:

A. Desert plants: These are plants that naturally grow in the Arabian Desert, such as tamarisk trees, Sidr trees, samor trees, arak trees and Camel's grass. When planted, they require full sun, and they are hardy when it comes to heat and dry weather.

B. Mediterranean plants: These grow in the northern and southern coasts of the Mediterranean. They are mostly fruit trees, such as grape vines, fig trees, olive trees, black seeds, safflower and pomegranate trees. They typically require partial shade to survive the summer heat.

C. Tropical plants: These grow naturally in warm rainy climates, and most of them are traditionally used as medicinal herbs or in making natural cosmetics. These include camphor, costus, ginger, saffron and agar-wood.

Black cumin plant, mentioned in Hadith, photo in QBG pilot nursery.

Costus plant inflorescence, photo in QBG pilot nursery.

Plants' Overview in the Holy Qur'an and Hadith

Many Qur'anic verses make direct mention of particular plants or use plant-related expressions such as "tilling" and "planting," among others. All of these verses refer to the greatness of God's creation and exemplify the impeccability of His power, as in **"And we sent down, from the rain clouds, pouring water that We may bring forth thereby grain and vegetation and gardens of entwined growth"** (An-Naba':14-16).

Plants were mentioned in other Qur'anic verses in contexts that describe heaven, such as **"In both of them are fruit, palm trees and pomegranates"** (Ar-Rahman: 68), and contexts that describe the rewards of the faithful in the afterlife, as in **"And fruit of what they select"** (Al-Waqi`ah: 20) and **"The companions of the right - what are the companions of the right? [They will be] among Sidr trees with thorns removed and [banana] trees layered [with fruit], and shade extended and water poured out, and fruit, abundant [and varied], neither limited [to season] nor forbidden"** (Al-Waqi`ah:27-33).

In other contexts, plants are mentioned in stern warnings against the types of punishment in hell, as in **"For them there will be no food except from a poisonous, thorny plant, which neither nourishes nor avails against hunger"** (Al-Ghashiyah: 6-7). Reference to plants is also made in the Qur'an where it instructs people on the best practices of preserving and storing food, as in Surat Yusuf **"[Joseph] said, "You will plant for seven years consecutively; and what you harvest leave in its spikes, except a little from which you will eat"** (Yusuf:47). This verse has served as the foundation for work in botanic gardens and seed silos.

Various uses of plants are repeatedly mentioned in the prophetic tradition (Sunnah). For instance, the Prophet describes those in heavens as people whose **"combs are of gold and aloes-wood will be used in their centers."** (Sahih Al-Bukhari, 55:544). Aloes-wood is traditionally used to make perfumes and incense. The Islamic Sharia calls for taking care of trees, increasing their numbers, given the good reward that we get from such deed, as the Prophet (Peace Be Upon Him) said: " **If a Muslim plants a tree or sows seeds, and then a bird, a person or an animal eats from it, it is regarded as a charitable gift for him until the Day of Judgment."**

No sacred plants in Islam

In the Hadith: when they (the Muslims) came out of Mecca with the Messenger of Allah, (PBUH) to area of Hawazen tripe, and they passed by the infidels Sidra tree called: Thata Anwaat, and saw the infidels worshiping it. The Muslims beginners asked the Messenger: Grant us a Sidra like theirs ,the Messenger of Allah, (PBUH) said: "Allah-Akbar (All the Greatest), you asked what the people of Moses had asked: {**"O Moses, make for us a god just as they have gods." Moses replied: "Indeed, you are a people behaving ignorantly"}.** The Prophet Muhammad then **said: You are repeating what the people before you had done".**

Islamic Vision

The Qur'anic Botanic Garden is supporting a very important Islamic vision and Allah's directives (e.g. value HIM and the world and all creatures HE created). The Qur'anic Botanic Garden's Islamic and spiritual concepts represent the fundamentals in worshipping of Allah. The Garden will disseminate Allah's instructions in relation to the preservation of the environment and protecting earth overall for the future generations.

The plants mentioned in the Qur'an and the Sunnah are sometimes unfamiliar to some readers. This is why the Qur'anic Botanic Garden, member of Qatar Foundation for Education, Science and Community Development, has led this initiative to study these plants and disseminate information about them.

Explaining and Identification of the plants, botanical terms and Islamic principles of conservation to a diverse audience of Arabs, non-Arabs, Muslims and non-Muslims is one of the main objectives in the Qur'anic Botanic Garden.

Roles of the Qur'anic Botanic Garden towards the Global world

Educational Role

The main goal of Educational Program of the Qur'anic Botanic Garden is to produce basic and applied information about plants especially the Qur'anic Botanic Garden's plants and related topics based on conservation and cultural heritage. Our education programs, Horticulture& conservation programs, dissemination activities, and partnerships are fundamental in ensuring the transfer of our knowledge to the global community.

Educational session delivered to student through environmental exhibition.

Environmental Conservation Role

The Qur'anic Botanic Garden aims to maintain and preserve the plants and the environment in general against any dangers or threats. The Garden is conserving special kinds of plants that collected from different parts of the world to be restored at one place for preservation and study purposes. The Garden is following the Islamic principles of Conservation in order to highlight these Ethics and explain them for all people. Garden emphasizes multi-activities, Campaigns, Events, Fairs and Exhibitions for the general public in order encourage people to preserve our natural resources.

Scientific Role

The scientific program of the Qur'anic Botanic Garden is concerning with Agricultural, Conservational, Biotechnology and Medicinal fields. The research program focus on studding the plants mentioned in the Holy Qur'an and Hadith, as well as it extents to study the endogenous plants of the Flora of Qatar. The Qur'anic Botanic Garden is also facilitating research for researchers whom searching on QBG plants and provides them with all the tools and data to perform these research tasks.

Study going on the endogenous plants of the Flora of Qatar by QBG technical team.

Historical & Cultural Role

The Qur'anic Botanic Garden aims to revival Cultural Traditions of the plants; it focuses on the traditional uses of the plants, their role in the human life, and the sustainable ways to use the plants for long term. The Botanical museum of the Garden is working on collecting those traditional entities from the entire world in order to be exhibited in the Information Center/ Botanic Museum of the Qur'anic Botanic Garden. The Garden also organizes events to deepen the spirit of cultural heritage to the current generation.

Entertaining Role

The Qur'anic Botanic Garden aims to be the first destination for the whole family, especially children, who can enjoy and do some environmental activities internally. The garden blends in harmony and a clear distinction between plants, water and Islamic garden's architecture which giving the Qur'anic Botanic Garden the fragrance of the old Islamic civilization. Also the greenery, shade and water are playing an essential role at the Qur'anic Botanic Garden in spreading joy and happiness to visitors, where they can relax between the folds of the beautiful landscape of the garden.

Families and students' engagement in Ghars Campaign, initiative of QBG.

Qur'anic Botanic Garden; a gate for an efficient framework

In addition to serving as a plants conservatory, the Qur'anic Botanic Garden is also a center of knowledge that preserves and maintains the natural, spiritual and cultural heritage of the Islamic World. The Garden aims to promote environmental awareness and to help integrate the Qatari Arab/Islamic cultural heritage into modern botanical sciences. The Garden's goal is to develop into an international center for education and research and to serve its mission in bridging cultures and promoting social responsibility toward the environment.

Agriculture

In terms of Agriculture, the Qur'anic Botanic Garden is aiming to coordinate with the local, regional and international organizations in developing of the standardizations for application of fertilizers, Irrigation, Pest control and plants pruning and training on garden level. It wants to enhance the water technicalities efficiency of the garden and sustainable use in irrigation e.g. subsurface, sprinkler or dripper irrigation.

Irrigation technique applied in the pilot nursery of QBG, Doha, Qatar.

In cooperation with many Botanical Gardens, the Qur'anic Botanic Garden of Qatar is going to Improve the soil quality in the garden for sustains growth of the trees and permanent plants and to be resistant or free of nematodes. The garden is Investigate in the optimum integrated pest control means under the climatic condition of Qatar, to overcome disorders of plant species of QBG.

Conservation

The conservation strategy of the QBG has two main poles; Ex-Situ and In-Situ Conservational Programs. The Ex-Situ conservation program (Conservation of the plants outside their natural Habitats) of the QBG is including the herbarium and seed bank units for both QBG's plants and for the indigenous plants of Qatar. The Garden is coordinating with the ministry of the Environment in Qatar to enrich the national seed bank.

Herbarium sheet prepared as part of conservation program of QBG.

The In-Situ Conservation program (Conservation of the plants inside their natural Habitats) is including an Ecological studies e.g. Surveys, assessments and GIS mapping, of recorded plants of the QBG in Qatar and those indigenous plants of the Flora of Qatar. The Garden right away is working with Qatari National protected areas and MOE on a project to evaluate some the biospheres reserves in Doha. Also there will be a project with KEW botanic gardens in the future.

Education

In cooperation with independent and international schools in Doha, the QBG has launched its educational program. The main goal of Educational Program of the Qur'anic Botanic Garden is to produce basic and applied information about plants, ethics and environment. Throughout its experimental nursery "Arboretum", classroom and herbarium units, the QBG was able to provide extra curricula activities for the different schools categories. The "little Botanist" is an educational program base on conservation provided by the QBG to the high school students of Grade 11 and 12. It focuses to provide the students with the main principals to study the vegetation Ecology in the desert.

Research

The Qur'anic Botanic Garden is opening a channel with Qatar Foundation's universities to study some the medicinal effects of some plants of the QBG. The garden is also facilitating research for researchers whom searching on QBG plants and provides them with all the tools and data to perform these research tasks.

Networking

The Qur'anic Botanic Garden starts to establish networks and partnerships with regional and global botanical gardens and institutes. The 2nd international forum of the Qur'anic Botanic Garden in collaboration with Commission on Ecosystem Management (CEM) of the International Union for Conservation of Nature (IUCN) is one of these successful partnerships with the global community. The Garden is working with sister gardens in the region, the Botanical Gardens Conservation International and other relevant organizations, to explore options for addressing these recommendations at the local, regional and international levels.

Group photo of pre-COP 18 seminar entitled "Plants, Environment & Climate Change".

THE SECOND INTERNATIONAL FORUM
OF THE QUR'ANIC BOTANIC GARDEN
ISLAMIC PERSPECTIVES ON ECOSYSTEM MANAGEMENT

A POETIC RENDERING OF ISLAMIC PRINCIPLES, VALUES AND ETHICS PROMOTING PLANT AND ECOSYSTEM CONSERVATION

Mrs. Diana Woodcock

These poems talk about plants and environment, wrote by Mrs. Diana Woodcock who teaches in VCU-QATAR. Prof. Diana delivered those poems in the forum of her passion towards preserving nature and ecosystem. [editors]

Mrs. Diana Woodcock
Virginia Commonwealth University in Qatar (VCU Qatar)
Email: dgwoodcock@vcu.edu

Introduction

Dr Batanouny's book, *Ecology and Flora of Qatar*, has inspired me to write so many poems that I now have enough to fill a whole book. In this first one, entitled "Yet in August," I introduce some of the plants mentioned in the Quran and try to emphasize the Islamic conviction that the Creator can be known through observation of His creation. One line near the end of the poem, "dormant seeds waiting for winter rains," is meant to highlight the Islamic concept of submission. This poem is an attempt to suggest that we must care for the "barren waste" as well as the cultivated.

YET IN AUGUST

Torn between the trellised and untrellised,
I praise plants from the Holy Qur'an,

cultivated fruit trees – date palm,
pomegranate, olive,
fig, ginger, grape,
Christ's thorn (sidra tree);

plants from the Hadith and Sunna –
Camel's hay, citron,
orfot and True senna.

Praise plants that bring me face to face
with creation, resurrection.
Yes, praise beet and kust.

Praise annuals – the cultivated:
onion, leek, and garlic;
mustard and sesame;
safflower and wheat;
rice and barley; lentil and
Black cumin.

Praise creepers and climbers:
melons; pumpkins; gourds.

Praise wild perennial herbs:
'heart of the desert' ones like Bitter gourd;
aquatic ones – wild ginger, cust root,
sweet flag, Narrow-leaved cattail, saffron.

Praise cultivated perennial herbs:
aloe, sweet basil. Praise desert shrubs:
Toothbrush tree and Salt tree;
cultivated shrubs Henna and Katam.

Praise wild desert trees: acacia,
Umbrella thorn, tamarisk.
Praise tropical/subtropical trees:
camphor, kamala, banana.

August gardens overflowing,
shamal winds blowing
over the arid desert landscape.
Mirages like mirrors.

Heat rising like incense
from the desert's heart.

Dormant seeds waiting for winter rains.
Beyond the tended garden,
not a hint of green.
Austere grace of a barren waste.
One Crested lark cries out against stark reality.
But oh the sound one dormant seed can make
splitting open hard-packed ground,
exposing parched earth's intimacies.

Yet in August, redemptive winter rains
seeming most improbable.

This next poem, entitled "Acacia," zeroes in on one species. By comparing human beings to the acacia ('Broken are we, out of sync with the universe/ while the acacia has not strayed one millimeter/ from the sacred way'), I am suggesting we have much to learn from nature and its faithfulness to its purpose. As I allude to how we are destroying His handiwork, I am emphasizing the Islamic directive to protect all that Allah has created.

ACACIA

Eating ice cream and candy,
I give thanks for the acacia –
for its Gum arabic.

In the desert, I come
into the shade of one and praise
its slanted, flat top.

Admire its wisdom: small leaves
for conserving water; thorns and
prickles keeping grazers at bay;

the heartwood's deposits of metabolic
wastes serving as preservatives –
making it unpalatable

to abrasive insects, resistant
to invasive fungi. Sole wood
used to construct the tabernacle

and all its features. Chosen
by Noah for the ark, by boat builders
in ancient Egypt and modern Sudan.

It shall be the reward for Heaven's people.*
Broken are we, out of sync with the universe
while the acacia's not strayed

one millimeter from the sacred way.
Listen how the Persian nightingale
still sings plaintively dawn and dusk

from its crown. A haunt from the beginning
till now for Little owl Athene noctua,
Crested lark, Southern Grey shrike,

White wagtail alike.
The acacia's austere stamina resonates
with the hermit's solitude and silence.

Some say acacia's no match
for Scotch fir. Still, I much prefer
it in its solitary stand against grains of sand.

For a moment, in its presence,
poisonous fumes hovering on the horizon
(oil flares) fade to an illusion.
*Qu'ran/Sura 56:27-33)

DESERT ECOLOGY 38: UMBELLIFERAE

Here's the secret to thriving
in this desert: taking part in the life
of lady's-lace – glabrous herb

sprouting in cultivated land. Listen
intently till you hear the lower leaves of each
bishop's-weed withering at anthesis.

Though you be heavy, notice
how each fruiting umbel opens
as if in flight. And though darkness

appears to reign, how each one—
long-peduncled—reflects one ray
of mysterious, glorious light.

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CONCLUSIONS & RECOMMENDATIONS

All life depends on healthy ecosystems to meet their needs. Due to over exploitation of earth's natural resources, pollution and climate change, our ecosystems are becoming severely degraded and losing the capacity to meet life's needs. Man and nature are out of balance, and we have lost our connection with nature. If the trend continues all life is at risk. This loss of connectedness with nature is linked to the loss of spirituality in relation to our natural world.

The Qur'anic Botanic Garden of Qatar, in collaboration with the IUCN Commission on Ecosystem Management, organized the 2nd International Forum (Doha 22-24 April 2014) to look at how the Islamic perspectives, as well as other religions are significant in Ecosystem management. The intent of this conference was to:

1. Highlight the work of the Qur'anic Botanic Garden in the State of Qatar especially in Ecosystem management from the Islamic perspective.
2. Bring together and engage local and international researchers, stakeholders and managers to deepen their understanding of how Islam and other faiths relate to the environment so as to foster more effective conservation of ecosystems.
3. Improve and stimulate international cooperation and exchange of ideas on the topics of Ecosystems management, Botanic Gardens' management, and traditional knowledge based on botany.
4. Explore new initiatives that can help and promote the role of the Qur'anic Botanic Garden in conservational programs.

Over the course of eight scientific sessions, a keynote lecture, the presentation of 26 scientific papers and discussions, the participants studied matters in the following four sessions:

- Qur'anic Botanic Garden: Islamic practices and perspectives of other religions in ecosystem conservation.
- Exploring opportunities and challenges in Ecosystem management.
- Sustainable management of the Botanic Gardens.
- Building a framework for collaboration to foster Ecosystems Management

Presentations looked at how religions, faith and spirituality can provide guidance on management and conservation of ecosystems. There was broad agreement that the texts of the Qur'an and other religions provided the means to raise awareness about the importance of conservation and management of the world's natural resources; that protection of the environment is the responsibility of all people and that they must share those natural resources equitably with all life. The world's ecosystems do not exist solely for the benefit of man.

This urgency to change human behavior provides an opportunity to revitalize cultural traditions and beliefs in relation to how we work with and value nature. To regain our balance with nature requires rekindling recognition of the inherent spiritual relationship that man holds with nature; that Islamic principles, and guidance provided by other religions and faiths, can change human behaviors and adoption of religious and spiritual values that have always been a fundamental aspect of nature conservation. In doing so there is need to respect all views, while ensuring transparency, focus, patience and commitment.

Four broad areas of common ground were identified:

1. Collaboration

Noting that botanical gardens are repositories of important religious, spiritual and traditional knowledge about plants and ecosystems; sources of important germplasm for restoration of ecosystems; and that they serve as repositories for ex situ cultivation of the earth's plant species, participants acknowledged the important role of Qur'anic Botanic Garden, the regional and global networks of other botanical gardens, IUCN and its Commission on Ecosystem Management and other scholarly institutions, to work together to raise awareness of the principles provided in the Qur'an and Hadith, that guide human behaviors and responsibility to conserve the world's ecosystems on which humankind and nature depend for their survival.

2. Ecosystem recovery based on religious beliefs, faith, traditions and spirituality

Understanding the urgent need to alter human impact on the world's ecosystems, participants urges Islamic and other religious leaders and faith-based groups to actively promote the sustainability and stewardship teachings that are found in religious texts through education and awareness programs and their conservation actions; for conservation organizations to recognize and support religious principles and spirituality in their conservation endeavors.

3. Documentation

Participants recognized the need to:

a. Document how different cultural traditions relate to nature and the environment, including documenting information (history, current status, why its importance) about the importance of plant species mentioned in the sacred texts, with a view to learning and sharing lessons; and

b. Research, clarify and document the names of plants mentioned in the Holy Qur'an, hadith, and other Holy scriptures, to aid in teaching people the history of these plants and the broader principles for protecting the world' ecosystems.

4. Conservation, scholarship and science

Participants recognized that while religious and spiritual values can motivate people to understand their responsibility for caring for the Earth and to engage more forthrightly in conservation action, it is also necessary that conservation action be informed and guided by science and scholarship, especially in regards to the social and cultural requirements for successful restoration and management of ecosystems.

What's next

Participants call on the Qur'anic Botanical Garden of Qatar and the IUCN/Commission on Ecosystem Management to establish a working group in consultation with sister gardens in the region, the Botanical Gardens Conservation International and other relevant organizations, to explore options for addressing these recommendations at the local, regional and international levels as soon as practicable.

THE SECOND INTERNATIONAL FORUM OF THE QUR'ANIC BOTANIC GARDEN

ISLAMIC PERSPECTIVES ON ECOSYSTEM MANAGEMENT

SPEAKERS LIST

FROM QATAR		
NAME	ORGANIZATION	EMAIL
Dr Kaltham Al-Ghanim	Center for Humanities and Social Sciences College of Arts and Sciences Qatar University	kaltham.alghanim@qu.edu.qa
Dr Ali Al-Qurradaghi	International Union for Muslim Scholars. Doha, Qatar	draliq@hotmail.com
Dr Jasser Auda	Qatar Faculty of Islamic Studies (QFIS), Hamad Bin Khalifa University	gasserauda@hotmail.com
Dr Mohammed Abu-Dieyeh	Department of Biological and Environmental Sciences. College of Arts and Sciences - Qatar University	dandelion@qu.edu.qa
Ms. Fatima bint Saleh Al-Khulaifi	Qur'anic Botanic Garden, Qatar Foundation for Education, Science and Community Development	fsalkhulaifi@qf.org.qa
Mrs. Diana G Woodcock	Virginia Commonwealth University in Qatar	dgwoodcock@vcu.edu
Dr Ahmed El-Batanouny	Doha Clinic Hospital	akbatanony@yahoo.com

INTERNATIONAL SPEAKERS		
NAME	ORGANIZATION	EMAIL
Dr Ahmed Al-Farhan	Faculty of Science, King Saud University, Riyadh, Saudi Arabia	alfarhan@ksu.edu.sa
Mr. Carlos Rodriguez	Tropenbos International, Colombia	carlosrodriguez@tropenboscol.com
Dr Edmund Barrow	Global Ecosystems Management Programme, IUCN, Nairobi, Kenya	edmund.barrow@iucn.org
Dr Gonzalo Oviedo	International Union for Conservation of Nature, Gland, Switzerland	gonzalo.oviedo@iucn.org
Dr Hany El-Shaer	Protected Areas, World Heritage & Business Programme, IUCN West Asia	hany.elshaer@iucn.org
Dr Hesham El-Tayeb	Botanic Gardens Research, Horticulture Research Institute, Alexandria, Egypt	heltayeb1@yahoo.com
HRH Princess Basma bint Ali	Royal Botanical Gardens of Jordan, Amman, Jordan	basmaali@royalbotanicgarden.org
Dr Iyad Abumoghli	United Nations Environment Programme (UNEP), Manama, Bahrain	iyad.abumoghli@unep.org
Mr. Josep-Maria Mallarach	IUCN World Commission on Protected Areas, Spain	mallarach@silene.es
Dr Lytton John Musselman	Department of Biological Sciences, Old Dominion University, Norfolk, USA	lmusselm@odu.edu
Dr Maximilian Weigend	Bonn University, Germany Rheinische Friedrich-Wilhelms-Universität Bonn, Germany	mweigend@uni-bonn.de
Dr Peter Wyse Jackson	Missouri Botanical Garden, USA Washington University in St. Louis, USA	peter.wysejackson@mobot.org
Dr Piet Wit	IUCN Commission on Ecosystem Management	wit.syzygy@gmail.com
Dr Sanjay Deshmukh	University Department of Life Sciences, University of Mumbai, India	sanjaydeshmukh@mu.ac.in
Dr Sara Oldfield	Botanic Gardens Conservation International, London, UK	sara.oldfield@bgci.org
Dr Shahina A Ghazanfar	Royal Botanic Gardens, Kew, London UK	s.ghazanfar@kew.org
Dr Stephen R Edwards	IUCN-Commission on Ecosystem Management, USA	prxs@me.com
Mr. Willem Ferwerda	Commonland Foundation, Amsterdam, The Netherlands	willem.ferwerda@commonland.com
Dr Zaghloul El-Naggar	World Islamic Sciences and Education University, Amman - Jordan	zaghloul_elnaggar@hotmail.com
Mrs. Shamsa Mohamed Al-Ketbi	Environment and Protected Areas Authority , Sharjah - United Arab Emirates	alketbi78@hotmail.com
Dr Angela Andrade	Conservation International, Colombia	aandrade@conservation.org

INTERNATIONAL PARTICIPANTS		
NAME	ORGANIZATION	EMAIL
Dr Briguy Lamizana	United National Environmental Programme, Nairobi, Kenya	birguy.lamizana@gmail.com
Dr Said Damhoureyeh	Faculty of Science, University of Jordan, Amman, Jordan	saidd@ju.edu.jo
Mr. Kelvin Passfield	IUCN Regional Office for Oceania	kelvin.passfield@gmail.com
Mr. Tariq Abu Taleb	Royal Botanical Gardens of Jordan, Amman, Jordan	tabutaleb@royalbotanicgarden.org
Mr. Tedros Medhin	Commission on Ecosystem Management, The Netherlands	tedrosm@hotmail.com
Mrs. Particia Hawes	Ecosystem Management Programme of IUCN Gland, Switzerland	Patricia.HAWES@iucn.org

ORGANIZING COMMITTEE		
NAME	ORGANIZATION	EMAIL
Ms. Fatima bint Saleh Al-Khulaifi	Qur'anic Botanic Garden, Qatar Foundation for Education, Science and Community Development	fsalkhulaifi@qf.org.qa
Mr. Ahmed E. ElGharib	Qur'anic Botanic Garden, Qatar Foundation for Education, Science and Community Development	aelgharib@qf.org.qa
Mr. Malik Karim Baloch	Qur'anic Botanic Garden, Qatar Foundation for Education, Science and Community Development	mbaloch@qf.org.qa
Mr. Mohamed M. Hassona	Qur'anic Botanic Garden, Qatar Foundation for Education, Science and Community Development	mhassona@qf.org.qa
Mrs. Sally Ahmed Kotb	Qur'anic Botanic Garden, Qatar Foundation for Education, Science and Community Development	selsayed@qf.org.qa

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