

How Traditional Ecological Knowledge addresses Global Climate change: the perspective of the Todas – the indigenous people of the Nilgiri hills of South India

Historical background of climate changes

Structurally, the Nilgiris and adjacent areas of the western ghats belong to the continental block of peninsular India that are made up of metamorphic Archean rocks, principally gneisses, charnockites and schists. These areas were part of the ancient continent Gondwanaland that connected India with Africa, South America, Australia and Antarctica. During the early cretaceous period, South America, Africa, Madagascar and India separated. During the mid-Eocene era – approximately 45 million years before present – the drifting Indian subcontinent, pushed against Asia. These phenomenal events lead to the formation of the mighty Himalayas. By the time the Himalayas were being formed during the Neogene era, the montane flora of the western ghats of South India had already acquired a distinctive character and this became more unique by being isolated as a result of increasing drought conditions over the Indian subcontinent. The species that survived this extended drought, managed to do so by becoming isolated within montane forest (shola) and grassland refuges in the western ghats. Long periods of isolation during intense drought conditions led to their evolution into distinct, endemic neo-species. Some of the Nilgiri endemic *Impatiens* species – like *Impatiens munronii* and *Impatiens jerdoniae* are directly related to African species and can be linked to a common ancestor from an unknown family in ancient Gondwanaland! The following Pleistocene ice age eras are thought to have decimated the existing Himalayan flora and this era also had a profound effect on the Nilgiris and western ghats in general.

The characteristic ecological features of the upper Nilgiri plateau at above 1200m are the shola-grassland ecosystem. This is called as a ‘climax’ ecotype and is the result of a balance that has come about due to three important factors:

- Due to firing by indigenous groups.
- Due to the harsh climatic controls prevalent in this area.
- Due to the climatic changes that occurred during the Pleistocene era.

All these contributed not only to the establishment of the shola-grassland ‘climax’ ecosystem, but also to the uniqueness of the Nilgiri upland island.

We shall examine all three factors:

1. Due to firing by indigenous groups. This especially relates to the ritualistic and practical aspects of setting fire to grassland by the Todas. The Todas would traditionally set fire – by means of a very sacred ceremony – to select areas of grassland, just after the onset of the frost season. Then they would migrate to specific hamlets located closer to the western edges of the plateau – where pasture would be adequate for their buffalo herds even during the dry months. This is due to the precipitation from moisture-laden mist that rises from the cliffs. They would return to their original hamlets at the onset of the monsoon, where the burned grassland would have sprouted fresh, young and succulent grasses by then.

Unfortunately the Forest service has not only put an end to this practice, but also caused immeasurable damage to this ecosystem by planting exotic trees like black wattle and eucalyptus extensively on the grasslands. Many rare, endangered and endemic plant species are on the brink of extinction due to this. The forest department chooses to ignore the fact that the Todas earlier managed a vast bio diverse wilderness for millennia, in a sustainable manner – something modern man has been unable to do subsequently.

2. Due to the harsh climatic controls prevalent in this area. There are several points to be noted here: a) during the winter months there is widespread hoar frost. At this time, since plenty of energy is radiated out at nights from open areas like grassland, the earth's surface temperature could easily drop to below freezing point. This however does not happen within adjacent sholas, as the microenvironment related to the trees; ensure that the ground temperature remains above 0°C. So in the grasslands, when the very sharp early morning winter sunrays rapidly heat up the earth's surface, the plants need to transpire rapidly so as to offset the sun's heating effect. But they are unable to draw up sufficient moisture from the soil – due to the frozen surface soil below. Hence these plants initially wilt, then wither and finally disappear during winter. A few plants like the rhododendron trees have learned to adapt to this phenomenon and thus survive within grassland, whereas most shola species cannot. b) Wind speeds can cross 110 km/hr, especially during the southwest monsoon. This is present all over the western plateau, although the winds are unbelievably fierce at the western edges – close to the escarpments. You can imagine what affect this has on small isolated plant species and only very hardy plants can survive this onslaught. The shola species are present in a closed forest canopy and are thus able to cope with the wind – it is always peaceful and calm within an undisturbed shola. In the grassland, only the species adapted to the wind factor have survived and indeed, actually thrive in these conditions! The few shola tree species that have managed to survive on open grasslands and hilltops are stunted and wind deformed. c) There is often drought like conditions prevalent during the late winter period – when there is hardly any rainfall for one or two months. This also has its effect on the ecology. d) The difference in diurnal temperatures – between night & day – can be as much as 22°C or more, in winter. This diurnal temperature amplitude is unique in the world and causes the plants to get singed, then become brown and lifeless. The absolute minimum temperature for the Nilgiris was recorded by Birch at: -8.9°C in 1838. e) In these areas, within a span of a few hours, the weather can change rapidly. There could be frost in the morning, followed by a bright, clear tropical sunshine capable of burning the skins of both animals & plants, then in a couple of hours, we could have a cooling effect from the thick mist rising from the cliffs. This mist often brings some precipitation as well. f) In the western areas, the rainfall – especially during the southwest monsoon is truly phenomenal and one of the highest in India. Take these examples: in 1961, the Western Catchment area III had a rainfall of 10, 867 mm with the rain recorded in July alone, almost 5000mm! In these areas, a rainfall of 1250mm (50 inches) in a twenty-four hour period is quite normal. Hence the term 'high rainfall grasslands' is used and the numerous rare species of plants that flourish during the wet season

- are called as hygrophytes. Due to this, the Todas never had any permanent settlements in these places and would come back to their original hamlets from the migratory ones, at the outset of the southwest monsoon. The Todas therefore address the harsh climate controls of the western Nilgiri edge by migrating there during the dry season and returning by the time the harsh monsoon sets in. Due to such heavy rainfall, the soils get leached out and this along with the harsh climatic conditions just mentioned, ensure that only grasses can dominate. As a result of the above factors, the typical shola forests are dense, with a closed canopy and with stunted trees usually located within hollows along hill-slopes (that are somewhat protected from the elements).
3. Due to the climatic changes that occurred during the Pleistocene era. A) 40000 to 35000 years: from recent peat bog studies of plant pollen grains, we now have some idea of how the upper Nilgiris looked like from forty thousand years before the present time. We finally realise that grasslands have coexisted with sholas for at least forty thousand years. At this period, the peat bog studies showed pollen belonging to the following plant genera: *geranium*, *justicia*, *lilium*, *berberis*, *strobilanthes* and *rhododendron*. These are all northern Himalayan species and it is believed that they moved south to the Nilgiris during this period. These are also all grassland genera and we can presume that grasslands existed even at that distant period. Although *rhododendron* is essentially a shola species, it is also found within grassland and can withstand all the harsh climatic conditions as well as fire. The studies indicate a cooler and drier climate during the period forty to thirty five thousand years ago. B) 35000 to 15000 years: during this period, the climate remained cool, but possibly became even drier. There was perhaps no monsoon during those days. During this phase, shrubs & trees began to dominate. Hence, the sholas began to expand at the expense of the grassland, substantially. A high degree of endemism also began to develop during this period, especially in savannah species like *impatiens* and *strobilanthes*. C) 15000 to 7000 years: during this phase, the climate became warmer and more humid. The southwest monsoon became active and drenched this area. The greater tree species pollen gathered from related soil horizons indicates the spread of sholas. Species like *elaecarpus* and *gordonia* that are commonly found today within sholas, were present in large numbers then. D) 7000 years to present: This period also marks the settling in by tribal populations including the Todas. Due to climatic factors and firing by humans, the sholas now began to decrease and the grassland increased rapidly during this period. Natural fires by lightning and other causes could also have contributed. The peat bog studies indicate an increase in pollen grains from grassland savannah species during this final phase. The following genera seem to dominate in descending order: Grasses of different species come first and far outnumber the others- ferns, *liliaceae*, *compositae*, *balsaminaceae*. Hence this indicates mostly savannah genera and hardly any pollen from shola genera.

Endemism: amongst fauna, we have a number of endangered animals & birds in this area. We know that the Nilgiris is home to a number of endangered mammals like the Nilgiri Tahr and the Nilgiri Marten. But it is the flora where the Nilgiris has a unique position in the entire western ghats. Two points need to be considered here:

- The presence of a large number of what are basically Himalayan species in this area. Like the *rhododendron*, *lilium*, *ilex*, *geranium*, *berberis* and many others. Even the Nilgiri Tahr and Marten are essentially Himalayan species.
- The other important fact is that this very small area has over ninety endemic plant species and varieties – that are not found anywhere else on earth. Sadly, many of these remain undocumented since the British days. It is possible that some of these might even have become extinct by this time – especially some *strobilanthes* species that existed in prime grassland that has now vanished. Of these, the *strobilanthes* and *impatiens* genera are most significant. Each of these is represented by around thirty-five species in the Nilgiris. Of them, *strobilanthes* has six endemics and *impatiens* a dozen.

That was the historical backdrop of the climatic variations that led to the development of the upper Nilgiri plateau as an isolated upland ‘island’. Therefore, the climate here is different – it is very cold compared to the adjacent areas, the flora is unique – over ninety endemic species and the rainfall is one of the highest in India. We shall briefly note the numerous ways by which the Todas have been addressing the changes in climatic patterns.

Hills

The Todas have scores of hills that are of varying degrees of sanctity. If we study the Toda ways of life, we realise that the historical and mythological connection with nature actually began soon after their ‘dream-time’. During the earliest times, the gods lived among the Todas. Each of their life stories is well known to many Todas, and natural landmarks associated with their exploits still exist. These gods and goddesses, after their time, went on to occupy various hill summits where they are still believed to reside. These are called as *taihhow tehtt*, or “deity peaks”, of which there are more than thirty. Even today, a Toda elder would not commit the sacrilege of pointing out the location of a deity peak with his finger – he would, in all likelihood, point at the neighbouring hill and say, “The peak next to that”. Therefore, the first sacred connection with nature, of the earliest Todas began when their gods took up residence in certain prominent peaks.

A typical Toda prayer consists of sacred chant words or *kwa(r)shm* to different natural landmarks like nearby peaks, slopes, valleys, ridges, shola thickets and specific sacred trees, to specific sacred rocks, swamps, meadows, pools, streams, besides to the dairy temple, sacred buffalo pen, pen-posts, pen-post bars and others. If one analyses all the prayers, we have a corpus of several hundred sacred natural features and if one attempts to map all the features that have survived the ravages of the march of civilization, then we have one important aspect of the Toda cosmography in place. Of the natural landmarks, the peaks are the most sacred entities and represent either a major or a local deity. A recent story relates to the construction of the hydroelectric dam at upper Bhavani a few decades ago. At this time, the workers started digging earth from the deity hills of *Aihzaihow* and *Mozaihow* that are situated in the vicinity. This earth was to be used for the construction work. Some Toda elders protested at the sacrilege being committed to

their sacred hills, but their words were not heeded. After a while, came the news that during the digging work, the earth had caved in and killed some workers. These hills were not touched thereafter.

Besides the deity peaks, there are the hills that are sacred to all Todas, but exceptionally sacred to one or occasionally clans – being almost on par with the deity peaks for a specific clan. But all the sacred hills have been protected and revered by the Todas. But today, when the forest service has taken over management, we find that some are planted with exotic trees like eucalyptus, others with tea and some are quarried for stone. This has taken its toll – with the hilltops that are planted with exotics no longer able to condense the mist into precipitation. The sacred hills that are untouched are still able to bring about localised rainfall – thus insulating them from the effects of global climate change. The Todas address this in three ways – one by doing their best to protect their sacred hills and another is by conducting an annual prayer ritual on a hilltop – to pray for normal climatic conditions. It is said that it rains soon after this ceremony. The third is by the chanting of the specific prayers associated with these peaks by the priest. This is believed to maintain a normal ecological health and repulse any extraneous effects on a global level. This holds true for other sacred natural sites, as we shall see.

There are other ways by which hills make the Todas aware of any changes in climate.

The Nilgiri peak is called *Kaa(r)sh gol* in Toda and is one of the most important deity peaks and is reputed to be un-scaleable and the location of several unique herbs. This hill is also related to the onset of the southwest monsoon. The mist first encircles and perambulates the sacred hill completely before moving to another distant deity hill of the God *Kawnttaihh*. After the mist encircles this peak, the monsoon sets-in in the rest of the Nilgiris within a week.

The sacred prayer words of *Kawnttaihh* refer to three conical projections that arise from this hill and are said to store the mist, wind and rain respectively. It is believed that the God whilst eating the *kaihh(r)sh* fruit (*Syzygium arnottianum*), spat out the seeds which became the mist, the air formed by the expulsion of his breath resulted in the fierce monsoon winds thereafter experienced in the upper Nilgiri plateau and his spittle became the monsoon rain. It is said that the mist does not leave these peaks until the southwest monsoon withdraws after some months and this is true during normal times. However, during some years when the monsoon is weak due to global effects, we notice that the mist has lifted and that either of these peaks is visible. The Todas then realise that this indicates a change in climate pattern and would have deleterious consequences on their environment. To obviate such an eventuality, the Todas gather annually on the same hill *Kawnttaihh* and along with the priest, pray for the well being of their environment including a normal monsoon.

Waters

Sacred Streams, Pools & Springs.

Every Toda hamlet that has a dairy temple would have sacred streams. One would be the ordination stream where the person undergoing the ritual is subsequently elevated to priesthood. Another is the sacred dairy temple stream from where the priest draws water for his daily use and for cooking. This is called generally as *pol(zh)y neepaw*, although each has a separate *kwa(r)shm* used by the priest in the prayer of the specific temple. In case a hamlet has two or three temples, then there would be a stream for each of them,

although sometimes a single stream may be used for more than one purpose. In this case, it would be that the higher course of the same stream is used for the more sacred temple. No person other than the priest or the priest- to- be can touch the waters of these two categories of streams. When a temple is reoccupied after an interval, or if the water is deemed to have been polluted by somebody, then the stream is purified with *tehhdr* bark (*Meliosma wightii*) by the priest. Most sacred hamlets also have another stream for the sacred salt pouring rites held during the year and again, the only the priest is allowed to draw water to dissolve the salt in.

In some temples of exceptional sanctity like the *Konawsh* conical temple, another stream is reserved for the Toda men to bathe and purify themselves before approaching the temple. It is noteworthy that these streams should be perennial as most temples are in operation during the dry season. The ecosystem is said to be in a state of ill health if and when any sacred streams run dry. This would generally be attributed to the alteration in the ecosystem by the adjacent plantations of exotic tree species by the forest service. Other possible reasons could be: due to pollution effects by extraneous elements on the sanctity of the temple and sacred area – this is explained later. Another reason could be the transgression of sacred rules by the priest – this is considered as most serious. One more factor attributed in modern times, is the change in the climatic patterns especially related to the southwest monsoon. At other migratory hamlets like *Teihhfakh*, there is a stream reserved for the guests to use for festive cooking on the migration day. Remember that every hamlet also has a non-sacred stream for regular domestic use. The segregation of sacred and domestic streams is marked and often, the priest who is returning to his hamlet touches the domestic stream as a final act of becoming a ‘layman’.

In addition to these, there are some other categories of streams. One is connected with the ‘dream time’, when the Toda Gods dwelled in the Nilgiris. For example, the pool *Nehrykaihrr* is from where the Goddess *Taihhki(r)shy* created the buffaloes and this pool is mentioned in the prayer of the conical temple at nearby *Pawshaihh*. Similarly, the stream called *Naihhrotkwehhdr*, where the God *Kwattaihh* tied down the reflection of the sun, making daylight into darkness, is mentioned in the prayer of the conical temple at *Konawsh*. There are many other examples. Then we have sacred streams or pools associated with the Gods that are not mentioned in prayers. For example, the pool in the stream *polpaw* near the Kurumba hamlet of *Pawny* (Tudiki), where the God *Kwattaihhn* came across the Goddess *Teihhkosh* bathing. We came across this amazing pool shaped like a circular buffalo pen, and engulfed in divine vibrations after a long and arduous trek. We have a singular example of a waterfall called *Awllvoy* that is classified as a deity site – almost all the others in this list are deity peaks. This is, of course, mentioned in many prayers. Finally, we have a number of streams and pools that are connected with the after world *Amunawdr*. One example is the stream *waskonskwehhdr*, where the departing female spirit places her pestle into a mortar shaped pit within the stream. Another is the large stream *pufehrrkheen*, where the spirit crosses a thread bridge en route the after world.

It is apparent that the Todas require the use of several streams in the vicinity of every sacred hamlet and site. If any of these ran dry, then the temple cannot be operated that season. And we have to note that most of the temples are opened during the dry season, when the waters are prone to the effects of global warming. In addition, we have seen that there are numerous other pools and streams related to the time of the gods and these too

are sacred. So how do they address the changes in global climate vis-à-vis their sacred waters? The first is again by treating each of these with veneration and many are mentioned in prayers by the priest with specific sacred chant words. I myself have seen the effect that defilement causes on such sacred waters even when they are in disuse. At the now abandoned hamlet of *Kashwehh* belonging to the *Kerrir* clan, the sacred dairy spring is called *Ooneer*. Since ancient times, only the priest has drawn water from this pool. Now that the hamlet is not occupied, other people may occasionally use this water - with utmost reverence we are advised. For eight years, I have been visiting this hamlet to observe periods of solitude in the wilderness. This sacred spring has always had water within, even during the driest months. Only twice was this observed to have run dry and both times, during the wet season. Once, this was traced to a non-Toda buffalo herder whose daughter had drawn water during menstruation. Soon after the rituals were performed to sanctify this pool, the water returned.

The second method is by ensuring that the ecosystem – be it shola thicket or grassland – around sacred water sources is preserved. Since the Todas know the specific plant species that conserve the hydrology of these ecosystems, they take special care to see that these species are abundant around water sources. This insulates the waters source from the effects of global warming. For example, during the summer months it is not unusual in recent times to experience a fairly long period of drought. However, due to conservation of the ecology especially the water retaining species, the sacred stream would still be perennial, albeit with less water. Most of these species have a complex subterranean ‘sponge’ like effect, but a few like *Oldenlandia verticillaris* hold ‘jugs’ of water within their large leaves. It is due to such plants that the western upper Nilgiris has the unique distinction of being one the few ecosystems where the precipitation and the areal water runoff levels (the ‘water yield’) are the same.

Rivers

Unfortunately, the two major river systems – the Mukurti-Pykara and the Avalanche have been dammed in recent decades. Both these rivers are the abodes of Toda deities and were venerated as divine forces. They could be crossed only on certain days and after observing austerities. They had specific crossing points – different for the priest and the lay people. There is a well-known story and song of how a man (not very long ago) crossed the sacred river in search of honey after engaging in coitus. These were two transgressions – one has to be pure both to cross the river as well as to harvest honey. The remains of his body were recovered later – apparently a tiger had killed him.

Now after damming, the entire sanctity of these two rivers has gone. Todas believe that the construction of several dams along the course of these rivers as well as their taming, with the resultant inundation of some of the most sacred temple complexes and migratory routes, is the cause of much of the misfortune that they and the ecology are suffering. They however do manage to pray to these rivers by standing atop a hill that overlooks the sacred rivers and hills. They also salute the previously existing sacred crossing points either during the summer months when the water from the reservoirs had been let out for power generation, or continue to pray at some places where the sacred river is still seen – especially when it flows from one reservoir to another.

Wetlands

The Todas have scores of swamps that are highly venerated and have sacred prayer names. These have once again undergone profound changes in recent times – inevitably for the worse. With the damming of the sacred rivers, many of the largest wetlands were inundated. This act also destroyed vast areas of extremely rich biological diversity – many of these species are endemic to the upper Nilgiris. These swamps have also been destroyed or altered due to: agriculture, planting of exotic trees on nearby slopes, over grazing, lack of firing –either naturally or by the Todas, and due to climatic changes on a global scale that have more recently been affecting the southwest monsoon. The main indicator species from which the Todas continually realise that their wetlands have been ‘swamped’ by other invasive plants, is the progressive and alarming decline of the grass used to thatch their temples – itself an endemic species.

Stones

In and around every sacred hamlet and site, there are several interesting rocks and stones that we just cannot miss. Many of these are sacred and have names that are chanted in prayers. Some of these may also have utilitarian aspects – like the specific rocks where the salt is ground for the salt ceremonies. Others have specific rituals performed by the priest – like pouring of freshly drawn milk from the sacred buffaloes. Some have been placed in ancient times to form either the walls of the sacred buffalo pens or of the temples. Many have interesting mythological stories associated and are thus of miraculous origin. Like the couple who went on a pilgrimage but were impure and thus turned to stone – the two vertical rocks show them looking in different directions just like the story narrates. Where the god is supposed to have made a steep stream flow ‘backwards’ by damming it – to show the others that he was their equal, has a huge cylindrical rock still by the side of the stream. Therefore, by treating various categories of rocks as sacred, the Todas are able to provide protection to various aspects of their ecosystem. Added to this is the fact that many of these sacred rocky areas are essentially the repositories of perennial mountain springs and streams. By protecting such zones by declaring them as sacred, the Todas have been able to offset to a large extent, the effects of climatic changes that might otherwise have led to the drying up of water sources. So we see that just declaring the waters as sacred might not suffice and so the Todas of ancient times also declared many rocks and cliffs as also divine.

Sholas & Grasslands

We have seen how the harsh climatic controls that prevail over the upper western Nilgiris have only allowed those plant species that could withstand these hardships, to survive and finally thrive. We also noted how the even harsher climatic changes that occurred during and after the Pleistocene era and continue to the present day, gradually ensured that only certain hardy floral species survived. And of these, only the fittest managed to exist and flourish in the open grasslands. This complex process has enabled the emergence of a ‘climax’ shola forest-grassland ecosystem. The Todas knew by instinct that such an ecosystem was better not altered with.

The sholas are the thickets of the upper Nilgiris composed of stunted montane evergreen trees that hold a variety of epiphytic flora including orchids, a forest floor containing a number of rare and endangered floras like wild balsams, and the ubiquitous stream. The

Toda relationship can be sacred – many thickets are generally sacred and/or contain specific divine objects like trees, rocks, pools, streams and of course- the sacred pathways used only by the priest. The other connection is utilitarian – the sholas house many of the important and often sacred flora used in various ceremonies and aspects of life. Grassland – the grassy downs that surround the sholas contain the sacred pastures, slopes, rocks, streams, milking grounds valleys and other important sites mentioned in the prayers. They also contain the floral species vital to various aspects of Toda life. Indeed, the sholas and grasslands of the upper Nilgiris actually constitute the basis of the Toda ecosystem. Without them, there would be no water and no biodiversity. As we shall see in the section on flora, the absence of any of the floral species normally housed in these ‘climax ecosystems’ and of water, indicates degradation in their vitality. These are attributed to actual destruction and/or plantations of exotic trees, agriculture, climate change and habitation.

The Todas being dependant upon their ecosystem devised several ways of managing it. Nowadays, with the disallowing of traditional management practices and the recent climatic changes, we see a large number of non-traditional species proliferating. For example, the Todas had a ritualised system of sacred firing of selected grasslands and swamps. This prevented weeds from spreading into these areas. They knew that the shola trees would not catch fire and that the few trees existing within grasslands were fire resistant.

Fauna

Climate changes in recent years on the Nilgiri foothills has resulted in certain faunal species that are not generally seen in the upper plateau to move to the upland. For example, large mammals like the Gaur (Indian Bison) and the Asian Elephant have started to move up to the highest reaches of the plateau. Certain non-resident birds too have moved up and some birds like the species of vultures have all but disappeared from the upper Nilgiris.

Not unexpectedly, various faunal species too have been conserved and indeed protected by the Todas by a twofold method. The first being their status as sacred albeit in some cases, feared creatures. But the difference being that these animals or birds physically ensured their own (Toda) sanctity rather than other aspects of nature that are treated as such. The second method is by eschewing meat and practising vegetarianism. This non-hunting trait is most unusual in a community that did not practise agriculture traditionally and where even today, game is abundant. Note that the Todas have a name and story for almost every animal and bird in their area.

We need to remember that the Todas herd a breed of buffaloes that are, like them, endemic to the Nilgiris. These are separated into the sacred and domestic herds. Each of the six grades of temple dairies has an associated grade of buffaloes that can only be milked by the priest of that particular temple grade. He incorporates a mind-boggling array of rituals into the seemingly mundane procedure of churning the sacred milk into various milk products. Therefore, these buffaloes are the most sacred and important facets of life to Todas. So, protection of these buffaloes from predators perhaps initiated their role as also sacred. We find that a tiger for failing to adhere to temple regulations carried even the son of the god *Kwattaihn* away. We have seen how a tiger killed a man in more recent times for crossing the sacred river in a state of impurity. Even today, we

are told of many instances of a tiger meting out justice when an errant priest thought that nobody had noticed his transgressions.

Birds too have a similar although a more varied role. The bird that plays the role of warning people of transgression of sacred rules is the Pied bushchat (*Saxicola caprata*) and is called as *kaarrpill(zh)c* in Toda. The House sparrow (*Passer domesticus*) is the one who helps in controlling the severity and duration of the monsoon and thus helps in addressing the effects of climate change!

Flora

The intimate connection with their flora exhibits the dependence of the Toda people upon their ecosystem and their uses, to be aware of and thus address, the effects of climate change. Broadly, this is done by:

1. Marking of all natural resources – notably the flora – that are likely to be used, or associated with, within a lifetime, as sacred and thus to be conserved. All these hundreds of species have sacred prayer names and are to be used in a sustainable manner. The Todas did so by remaining within the natural cycle and keeping their own population levels low – even today, restricted to 1400.
2. Usage of specific floral species in various lifetime ceremonies. Since these cannot be substituted, these species just have to be abundant around all hamlets. The most important uses that Todas have for the plants in their homeland are cultural. Every ritual or ceremony, be it of birth, pregnancy, paternity rites, priests' ordination, the elaborate dairy temple rituals and ceremonies, or the funeral rituals, all of these are centred on the use of specific species of plants. One reason why the Todas have preserved their ecosystem well is their dependence upon these plants for their culture. And why have these people preserved their cultural ethos? One important reason is the belief that only a person who has performed the mandatory lifetime rituals is qualified to take residence at the after-world *Amunawdr*. Therefore, as long as this is believed in, the Todas would continue to preserve their culture and as long as this is done, they would strive to preserve their environment. For example, the pregnancy and paternity rites entail the use of the following plants: *Arundinaria* sp. of bamboo reeds; *Mappia foetida* leaves; *Rhododendron arboreum* ssp. *Nilagiricum* sticks; *Rubus ellipticus* leaves; *Myrsine capitellata* branches; *Syzygium arnottianum*; *Sophora glauca* branches and *Andropogon schoenanthus* grass. So, if all the species used in a Toda's rituals and culture were to be counted, we would have a total of more than one hundred plant species that are required in the vicinity of each hamlet.
3. Usage of specific plants in the construction of traditional structures. Similarly, the barrel vaulted and conical temples are also constructed using only specified forest produce like: *kwehtf* or *paarsh* (*Sideroxylon* sp.) tree poles; specified wooden planks or stone slabs; rattan cane (*Calamus pseudo-tenuis*); *waadr* bamboo reeds (*Arundinaria wightiana* and *A. w.* var. *hispida*); other bamboo species' sticks; specified wood for the door and carved *kweghaishveil* that is like a totem placed vertically atop the thatch; *teff* - thin bamboo reeds (*Pseudoxytenanthera monadelphica*); and a swamp grass called *avful* – an a species endemic to the western Nilgiris and identified in a study by us as *Eriochrysis rangacharii* - by the Todas. Again, if any of these once plentiful species were to get depleted, the Toda

culture would be at the crossroads, as they are not allowed to substitute with other species. Taken a step further, if any of these were to become locally extinct, then their culture could collapse in a short period. All the above three points helped the Todas ensure the health and climax status of their ecosystem – thus insulating it from the effects of global climate change. This was largely due to the creation of a microclimate within specific areas.

4. Using specific indicator species that show different facets of the Toda way of life and indicate climatic changes accurately.
 - As indicators of the different seasons in a year and of each stage within every season. To give an example of the southwest monsoon, the indicator species for the immediate pre-monsoon phase are: *avfulazhky* and *nicazhky* – both belonging to the *Oldenlandia* genus and are ubiquitous during May. An ancient song and story refer to a sacred buffalo that came to this world from *Amunawdr* and calved, when the flowers of these two bushes were blooming. From this we know that this story occurred during the month of May. The name *avfulazhky* literally means ‘puffed rice’ and it is apparent that this derives from the unopened buds of this plant that closely resemble grains of this food. Another plant that flowers during this period are the different species of *arisaema* or the ‘cobra flowers’ called *poddwa(r)shk*. The early monsoon is indicated by – *Ceropegia pusilla* (the ‘churning stick’ plant), *Drosera peltata* (an insectivorous sundew) and the orchid *Calanthe triplicata* (the leaves are used to make a vessel to hold honey in). The delicate *Anemone rivularis* blooms denote the peak monsoon. The final phase is represented by the most handsome of all Nilgiri wildflowers, the Nilgiri lily – *Lilium neilgherrense*. The final phase of the monsoon in early September is also the most vitriolic. I once told a Toda elder *Kwattawdr Kwehhttn* that the rains showed no signs of abating and he assured me that the monsoon would end within a week. He explained that the sacred *maw(r)sh* trees (*Michelia nilagirica*) had started flowering en masse in the sholas, thus indicating the impending end of the south-west monsoon. From that time, I have noted that this botanical indicator of the cessation of the monsoon is remarkably accurate. The other seasons and intervening stages are also similarly indicated by specific species during their flowering cycles.
To a Toda, their ecosystem is in good stead if all the indicator species flower at the precise time that the corresponding stage of every season commences or ends. In areas where the ecosystem is intact, the microclimate generated offsets the changes in climate. But when such changes are severe – like an extended drought during the dry season or a delayed monsoon, the corresponding floral indicators of that season go haywire and do not bloom accurately.
 - As indicators of the climatic pattern of a particular period of the year. The Todas have terms for the differing climatic variations that every season brings. The precise flowering of corresponding species of plants denotes these. And the relationship does not end here. The climatic

pattern of that period, the species flowering and the star most prominent in the sky, all have the identical names. The ecosystem is therefore said to be vital only if all elements of this climate-flower-star triad are in perfect synchronicity. Any change in climatic pattern first affects the flowering cycle of the indicator species. For example, a change in the intensity of the southwest monsoon in recent years has caused the peak monsoon indicator – *Anemone* sp. not to bloom in profusion, but very sporadically.

- As indicators of the prominent star visible in the evening and night sky during a particular period. This has been explained above. By early October, the pre-monsoon showers from the northeast monsoon commence. The weather pattern is peculiar, with fragmented showers of rain giving way to a clear sky – this is called as *kaashtk*. A star also of this name is visible in the night sky of this period and an exquisite flower *Exacum bicolour*, again called *kaashtk* is simultaneously mass flowering. This is the indicator for this period and climate of the year. The Todas have 28 such star-weather-plant triads representing different phases of the year and the genus *Impatiens* or *nawtty* are part of this series. Changes in these triads not only cause the indicator species and the climate to be disturbed, but the corresponding star might not be that visible as well.
- As indicators of the abundance and/or depletion of species. Certain species like *Strobilanthes* and some bamboos, flower in precise cycles of many years. As long as they continue to do so at the precise intervals – the Todas are aware of the number of years after which each of these should bloom – the ecosystem is deemed to be in fine tune. Changes are usually due to alteration in the ecology or climatic variations. An equally profound dying down follows mass flowering.
- As indicators of the availability of honey. To assist in the practice of honey gathering, the Todas have not only noted when different species flower, the kind of honey produced, but also the insects and bees that pollinate them. This is elucidated in an ancient song that elaborates on when specific flowers are in profusion, the corresponding species of bees that are pollinating them. Today, when climatic changes cause some tree species not to mass flower at the correct time, the Todas realise that something is profoundly wrong with their ecosystem and that honey is not going to be available that season.
- As indicators of various items that their ancestors were inspired by. For example, the flowers of *Ceropegia pusilla* were used to model the unique cane milk churning stick. And interestingly not only do these endangered flowers look like miniature churning sticks; their tubers are also highly nutritious. Similarly too, the circular buffalo pens said to have been inspired by the shape taken by a clump of *Gaultheria* sp. bushes. This is the wintergreen used in our pain balms. Flowers also inspired several embroidery motifs and continue to inspire song compositions. The Todas are aware that climate changes are behind the

depletion of the edible ‘churning stick’ plants as also the wintergreen bushes not being seen in circular clumps that often.

- As indicators of human reaction. For example, an herb that blooms on the grasslands of the Toda heartland, are the small flowers of *Gentiana pedicellata* called as *arkilpoof*. This Toda name literally means: ‘the worry flower’ and the flower indicates the anxiety levels of humans. This carpets the grassland and sometimes it difficult to walk without treading upon these delicate blooms. It is believed that if a person with worries plucks this plant and holds it in the hand without touching the flower, the flower closes. It is very sensitive and closes faster if the degree of anxiety is pronounced. We have experimented with this over the years and found it to be very accurate – whenever a person with some nagging worry accompanied me, this flower would close in a flash. As long as such species are present at the right period and continue to show the correct reactions, the ecosystem is normal. Since most such plants are hygrophytes, climatic changes leading to variation in monsoon intensity have lead to their scarcity in many areas.
- As indicators of the time. For example, the Todas have depended upon certain plants for their flowers to indicate not only the season of the year, but also the time of the day. One prominent example of this is the ‘six o’clock flower’ (*Oenothera tetraptera*) that blooms at almost exactly that time in the evening irrespective of regular weather conditions. However, climatic variations on a global scale can affect the accuracy of such species.
- As indicators of a persons’ age and wisdom. The Todas have a good knowledge of several *Strobilanthes* species depending upon their flowering cycles and the medicinal qualities of the honey they ultimately produce. These are called generally as *katt*, with *tehrverykatt* flowering once in six years, *pelil(zh)ykatt* every twelve years, and *pyoofkatt* mass flowers after eighteen years. This is also used to denote a man’s age and wisdom – a man is said to be extremely wise if he has witnessed several flowering cycles of *pyoofkatt*. It is noteworthy that in the past, this species was present around every hamlet and therefore anyone who had seen it flower twice would know that he/she were 36 years old and so on. Nowadays, with rapid alteration in the ecosystem and the changes in climate, a Toda just cannot rely on this for one’s age.
- As indicators of the specific pollinators. As noted, this was primarily related to honey gathering. But this knowledge also helps in a Toda understanding that the absence or decrease in a specific pollinator would mean that the corresponding plant species would also diminish in the following season. He can understand that the absence of the pollinator is either due to alteration of habitat, use of pesticides or climate change.
- As indicators of sacred temple species. There are some species like the bark of the *Meliosma wightii* tree that can only be used by a priest and

nobody else. Several thorny plant species are used during ordination ceremonies of the priest, to purify him.

- Mass flowering as indicators of the impending wild fruit season.
 - Mass flowering as indicators of the availability of herbs. Like those called as *ezhtkwehhdr* the powdered bulbs of which are consumed as outstanding energisers – a sort of Toda *ginseng*. The Toda name of this species (*Satyrium nepalense*) means literally: ‘bullock horns’ which is what these flowers resemble individually when plucked. Besides, from a botanical perspective too, this is striking as it shows (the fact that it was related to the horns of a bullock) that the Todas were aware of their uncommon twin spurred flowers - most orchids otherwise have single spurs. This species has reduced drastically in certain eco-altered areas that were unable to maintain their own microclimates in the face of global changes. This shows the botanical knowledge of the Todas.
 - As indicators of certain toxic species to be avoided. The tubers of the cobra plants belonging to the *Arisaema* species are known to be toxic.
 - As indicators of certain utilitarian properties. Some bamboo species are used to make flutes; others are used in the construction of traditional structures, yet others are used to make sacred vessels. Rattan cane is used for a variety of uses. Some sticks are used to fabricate spears. The leaves of the terrestrial orchid *Calanthe* are used to make a vessel to hold honey. Amongst the plants used routinely by the Todas in their rituals for practical purposes are those of the species *Litsea wightiana*. The thin branches of these are dried and used to make fire by friction and fire cannot be made by any other means at ceremonies. Finally, the species of grasses used for thatching purposes are known to provide prolonged shelter from rain.
 - As indicators of the presence of unusual and visually striking species. Many of the plants endemic to the upper Nilgiris belong here. There are over a dozen endemic balsams – *Impatiens* in the Nilgiris and the Todas are able to indicate their absence from certain areas to changes in ecology and climate.
 - As indicators of wild foods and grains. The edible tubers of the ‘churning stick’ plant are in this category.
5. By incorporating certain sacred rituals that directly assisted in the management of the ecosystem. Traditionally, every year the priests of the highest-grade temples would initiate a sacred ritual of setting fire – with fire sticks – to certain areas of the grassland at the start of winter. Although this was done for ritual purposes, they had a larger role of managing the grassland ecosystem. With the forest service disallowing the firing rites, and the changes in climatic conditions, we have noted the alarming decline of vital species like the endemic *Eriochrysis rangacharii* – the specific species used to thatch temples.
 6. By incorporating certain sacred rituals that indirectly assisted in the management of the ecosystem. Like the salt pouring ceremonies performed by the priests at all temples during different periods of the year, for the sacred buffalo herds. Besides the utilitarian aspect of feeding brine to buffaloes (in an area almost devoid of

natural salt), this ceremony is basically a prayer for an abundance of rain and hence pasture and hence milk and other vital natural resources in the coming months. Ceremonies like these are a plea to the divine to bless and maintain the health of their ecosystem. Failure to perform the salt rites even today is an invitation for climatic changes and resulting ecological ill health. We have noted another ceremony where the Todas gather annually on a sacred hilltop to pray for good rainfall and normal climatic conditions. Besides these, a few Todas claim to possess the ability to chant sacred incantations that can either bring about localised rainfall or to withhold it for a short period.

7. By practicing vegetarianism – an unusual trait amongst indigenous people surrounded by game.

Toda Ecological Footprint

It has been calculated that the ecological footprint (see graphs) of an average US citizen is 8000 Kg oil equivalent and the CO₂ emission: 20, 000 units. Compare this with those of an Indian: 500 kg oil equiv and an average CO₂ emission of 1000 units. Of course, in this consumerist monoculture world, the eco-footprint is directly related to the per capita income (PCI) of the nation. The USA has a PCI of 35000 USD whereas the Indian is lagging far behind at just 700 USD. At the same time we realise that if India were to increase its PCI by fifty times, then its eco-footprint would also reach 8000 kg oil equiv. One can then visualise the impact this ‘growth’ would have on the ecosystem – keeping in mind the Indian population. In fact, Edward O. Wilson has calculated that for the developing world including China and India, to reach current levels of the developed world, it would require four planet earths to sustain this phenomenal growth.

So what would be the ecological footprint of a modern Toda? We could calculate the PCI to be around 300 USD which is less than half that of an average Indian. Even today, less than one out of every 100 Todas owns a vehicle (including two wheelers). Compare this with a 1:1 ratio in the US. Therefore, emission of CO₂ from this source is negligible for a Toda. And air travel is almost non-existent amongst Todas.

But you might ask – what about burning of wood to supply energy? Yes, the Todas do rely totally on wood as a source of fuel. And while the government is going all out to ‘modernise’ these people by providing them with modern style housing, these too remain small and have little cement and more mud. Toda traditional houses are marvels of tribal architecture. These can last for many decades, only requiring periodic re-thatching, in areas where the annual precipitation can reach 4000m.m. Besides, even when it is bitterly cold or windy outside, these are very warm within. It is important to keep a fire burning as much as possible as this makes the various components bind into one cohesive unit. Despite having hardly any foundation, they act as natural windbreakers and remain intact even after the most violent storm. They also blend superbly with the undulating terrain and do not stand out like modern houses do in the grassy downs. The entrances are very low and small and this ensures that no enemy or wild animal is able to enter that easily. We have already seen the specific species of raw materials that are used for the construction of traditional structures.

In the early 1990’s there were just half a dozen barrel-vaulted houses remaining. All except one of these was situated in migratory hamlets where no other forms of housing are allowed. Then one man asked us to obtain government sponsorship for a barrel

vaulted house as his ailing father wanted to depart in a traditional house. The rest as they say, is history and over the past ten years, we have approached government and private agencies for sponsoring traditional houses. Today, we have been able to assist in funding over forty barrel-vaulted houses. Added to these are the scores of existing temples – two are conical and the rest barrel-vaulted.

It is noteworthy that these traditional structures use natural products that are sustainably harvested from a climax ecosystem – where the consumption and emission of carbon are already balanced. The raw materials are renewable and harvested when mature and hence have already served the vital function of capturing carbon during their growth. Secondly, a fascinating aspect is that traditional structures have the unique property of not emitting carbon into the atmosphere from the wood burned within. **Hence these structures are actually able to capture and sequester carbon within.** Therefore, they are most eco-friendly and should be promoted amongst the Todas. In fact, a traditional structure cannot survive for long without the fuel wood being burned within. They require the smoke to be absorbed within all components and this binds the various raw materials into a cohesive unit structure. **We can conclude that the ecological footprint of a Toda is barely traceable on the ground and in the air.**

TARUN CHHABRA
Hospital Road
Ootacamund – 643001
Nilgiris
India.
kwattein@sancharnet.in