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ARTICLES

சங்க இலக்கிய ஐந்திணைகளின் பாரம்பரியச் சூழலியல் அறிவும் ஈரோடு மாவட்டத்தின் உள்ளூர் அறிவுமரபுகளும்: மண், நீர், பருவநிலை, தாவரங்கள் மற்றும் விலங்குகளை மையப்படுத்திய இலக்கிய–கள ஆய்வு

Traditional Ecological Knowledge in the Sangam Aintiṇai and Local Knowledge Traditions of Erode District: A Literary–Field Study of Soil, Water, Climate, Flora and Fauna

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ABSTRACT

This study presents a comparative analysis of the Traditional Ecological Knowledge (TEK) embedded in the five landscapes (Aintiṇai) of Sangam literature – Kurinji, Mullai, Marutham, Neithal and Palai – and the contemporary local knowledge traditions of Erode District, Tamil Nadu. Drawing on literary evidence, the ecological elements of the Sangam texts, including soil, water, climate, flora and fauna, are systematically categorised and analysed to understand human–nature relationships and their practical applications in ancient life. Concurrently, a field-oriented approach is adopted to document soil types, water resources, biodiversity, climatic variation and indigenous knowledge across the diverse ecological zones of Erode District, encompassing mountainous, forest, agricultural, riverine and dryland regions. Field sites such as Sathyamangalam, Thalavadi, Asanur, Bhavani, Gobichettipalayam, Perundurai and Anthiyur are evaluated against the ecological frameworks of the five landscapes. The traditional knowledge is validated by combining literary sources with oral histories, field observations, soil and water testing, floristic and faunal documentation, and rainfall data. The findings illuminate the holistic socio-ecological nexus of land, water, flora, fauna, climate and people in the Sangam era, while highlighting its continuity, adaptation and degradation in the modern context. The study demonstrates the potential of integrating traditional ecological wisdom into contemporary conservation strategies, natural resource management and sustainable living practices.

ஆய்வுச் சுருக்கம்

சங்க இலக்கியங்களில் பதிவாகியுள்ள குறிஞ்சி, முல்லை, மருதம், நெய்தல், பாலை ஆகிய ஐந்திணைகளின் பாரம்பரியச் சூழலியல் அறிவையும், ஈரோடு மாவட்டத்தின் இன்றைய

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உள்ளூர் அறிவு மரபுகளையும் ஒப்பாய்வு செய்வதை நோக்கமாகக் கொண்டுள்ளது இவ்வாய்வு. சங்க இலக்கியங்களில் இடம்பெறும் மண், நீர், பருவநிலை, தாவரங்கள், விலங்குகள் ஆகிய சூழலியல் கூறுகள் இலக்கியச் சான்றுகளின் அடிப்படையில் தொகுக்கப்பட்டு, அவற்றின் இயற்கை தொடர்புகளும் வாழ்வியல் பயன்பாடுகளும் ஆராயப்படுகின்றன. இதனுடன், ஈரோடு மாவட்டத்தின் மலை, காடு, வயல், ஆற்றுப்பகுதி, வறண்ட நிலப்பகுதி ஆகிய சூழலியல் நிலவெளிகளில் காணப்படும் மண் வகைகள், நீர்வளங்கள், தாவரங்கள், விலங்குகள், பருவநிலை மாற்றங்கள் மற்றும் உள்ளூர் அறிவு மரபுகள் கள ஆய்வு நோக்கில் அடையாளப்படுத்தப்படுகின்றன. குறிப்பாகச் சத்தியமங்கலம், தாளவாடி, ஆசனூர், பவானி, கோபிச்செட்டிப்பாளையம், பெருந்துறை, அந்தியூர் உள்ளிட்ட பகுதிகள் ஐந்திணைச் சூழலியல் கூறுகளுடன் ஒப்பிட்டு நோக்கப்படுகின்றன. இலக்கியச் சான்றுகள், உள்ளூர் மக்களின் வாய்மொழித் தகவல்கள், களக்கவனிப்புகள், மண்-நீர் பரிசோதனைகள், தாவர மற்றும் விலங்கு ஆவணங்கள், மழைப்பொழிவு மற்றும் தொடர்புடைய தரவுகளின் வழியாகப் பாரம்பரிய அறிவு சரிபார்க்கப்படுகிறது. இவ்வாய்வு, சங்ககாலத் தமிழரின் இயற்கை அறிவில் காணப்படும் நிலம்–நீர்–தாவரம்–விலங்கு–பருவநிலை–மனிதன் ஆகியவற்றுக்கிடையிலான ஒருங்கிணைந்த உறவையும், அவற்றின் இன்றைய தொடர்ச்சி, மாற்றம், சிதைவு ஆகியவற்றையும் வெளிப்படுத்துவதோடு, பாரம்பரியச் சூழலியல் அறிவைச் சமகாலச் சூழலியல் பாதுகாப்பு, இயற்கை வள மேலாண்மை மற்றும் நிலைத்த வாழ்வியலுடன் இணைப்பதற்கான வாய்ப்புகளையும் எடுத்துக்காட்டுகிறது.

திறவுச் சொற்கள்: சங்க இலக்கியம்; ஐந்திணை; பாரம்பரியச் சூழலியல் அறிவு; மண்; நீர்நிலைகள்; தாவரங்கள்; விலங்குகள்; ஈரோடு மாவட்டம்

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1. Introduction

Sangam literature is the ancient literary treasure of Tamil that records human life and nature as a single, integrated whole. The theory of the five landscapes (*aintiṇai*) is a foundational element of traditional ecological knowledge, revealing the natural interrelationship of land, water, climate, plants, animals and people. The Sangam poets classified the land into *Kurinji*, *Mullai*, *Marutham*, *Neithal* and *Palai*, and they recorded in fine detail the soil, water resources, climate, plants, animals, birds, agriculture and ways of life proper to each landscape. Sangam literature is therefore not only a body of literary creation but also an important document of the ecological knowledge of the ancient Tamils and of a way of life in harmony with nature.

The Tamils of the Sangam age did not regard nature as something external to themselves; they lived as a part of it. Practices such as cultivating according to the character of the soil, maintaining water bodies, farming in step with the seasons, and treating plants and animals as resources for life reveal both their knowledge of nature and their sense of environmental responsibility. The relationship among soil, water, climate, plants, animals and people lies at the heart of Sangam ecological thought.

Reading Sangam ecological knowledge alongside the natural environment of present-day Erode District helps us understand both the continuity and the changes between ancient knowledge and the contemporary ecological condition. By comparing the soil, water, climate, agricultural setting, plant wealth and animal diversity of Erode District with the knowledge of nature found in Sangam literature, we can assess how far the traditional ecological

knowledge of the Tamils fits today's conditions, and we can also understand the changes that have taken place and the ecological challenges that must now be faced. An integrated study, from the perspective of "Sangam literary ecology", of the *aintiṇai* knowledge of soil, water, climate, plants and animals together with the present ecological situation of Erode District is thus an attempt to bring out the traditional Tamil knowledge of nature and its present-day applicability.

1.1 Objectives of the Study

The study has five objectives:

1. To compile the elements of ecological knowledge relating to soil, water, climate, plants and animals in the five landscapes of Sangam literature.
2. To formulate, as research hypotheses, the corresponding landscapes of Erode District and their local knowledge traditions.
3. To design a protocol suitable for field documentation and scientific verification.
4. To propose a digital repository framework based on GIS and the digital humanities.
5. To identify possible applications for sustainable agriculture, water conservation, biodiversity and climate resilience.

1.2 Approaches of the Study

1. Literary-critical approach
2. Ecological approach
3. Local-knowledge approach
4. Field-study approach
5. Comparative approach
6. Historical approach
7. Human-ecology approach
8. Biodiversity approach
9. Traditional climate-knowledge approach
10. Geographical (GIS) approach

2. Ecology

The environment includes all the natural elements that surround human beings – nature, living organisms, soil, water, air, plants and animals. Humans and their environment depend on each other. The origin and development of humankind are closely bound up with the natural environment. In the Sangam age, people obtained the food, water and shelter they needed for their livelihood directly from nature, so that an inseparable relationship arose between the basic needs of human life and nature. Over time, with the growth of science and technology, the extent to which humans exploit nature increased, and many changes occurred in the natural environment.

The living arrangements that humans have created by modifying nature for their own needs are called the "man-made cultural environment". Houses, roads, cities, factories, dams, bridges and farmland are examples. Although these make human life easier, their impact on the natural environment must also be considered. Over-exploitation of natural resources, deforestation, the disruption of water bodies and the depletion of soil fertility all affect ecological balance.

2.1 Ecology: Definition

The Tamil term *cūḻaliyal* corresponds to the English word "ecology", which is derived from Greek. It combines two words, *oikos* and *logos*. *Oikos* denotes a house or a place to live, and *logos* means study or discourse. Ecology is therefore generally understood as the study of living organisms in the places where they live. P. Chandrasekaran observes:

> *"The word 'ecology' was proposed by the zoologist Reiter (1885). The word originates from Greek. Oikos means a dwelling place or home; in Tamil this is rendered as cūḻaliyal. Logos means discourse or study. Thus, literally, the word ecology means the study of living organisms, including plants and animals, and of the habitats in which they live." (Chandrasekaran, n.d., p. 1)*

2.2 Ecology: Lexical Meaning

The *Cre-A Dictionary of Contemporary Tamil* defines the word *cūḻaliyal* as "the totality of natural objects surrounding the place where human beings live; the set of mental factors that bear on human action" (Cre-A, 2008, p. 466).

S. Subramanian, in his dictionary of educational terminology, describes it as "the discipline concerned with the relationship between living organisms and their surroundings" (Subramanian, 2006, p. 93).

The *Narmada English–English–Tamil Dictionary* explains it as "the research knowledge of the air, land, water, animals, plants and other organisms as they exist in relation to their surroundings" (Narmada, n.d., p. 287).

2.3 The Biosphere

The natural environment that makes life on earth possible is called the biosphere. The biosphere includes not only human beings but all living organisms, including plants, animals and micro-organisms.

In addition, the technological environment created by human beings is called the technosphere. Through the growth of human science and technology, the human impact on the natural environment continues to increase. Urbanisation, industrialisation, changes in agriculture and the growth of transport have greatly increased the use of natural resources.

2.4 Air and the Environment

Air is another important component of the environment. Clean air is indispensable for human beings and other living organisms. Human activities such as industry, vehicles, the burning of fuel and the burning of waste cause air pollution, which can harm human health and the lives of other organisms. Measures to reduce pollution must therefore be taken to protect air quality.

Air is as important to human life as water and land, and it must be kept clean. It is trees that purify the air, and those who live in the hills continue to protect these trees even today. Sangam literature records that people used trees only for their own needs, as the following *Purananuru* verse shows:

குறத்தி மாட்டிய வறல் கடைக்கொள்ளி

ஆரம் ஆதலின், அம் புகை அயலது

சாரல் வேங்கைப் பூஞ் சினைத் தவழும்

The dry firebrand that the hill-woman fed to the hearth,

being sandalwood, sends its fragrant smoke drifting

over the flowering boughs of the vēṅkai on the nearby slope.

— Purananuru 108

This verse shows that the people of the Sangam age cut and used trees only for their daily needs. Today, by contrast, trees are felled excessively and against the order of nature, the air is polluted and the environment suffers severely. Air pollution brings many new diseases, including respiratory illnesses. To prevent this, we too must live in harmony with nature, as the people of the Sangam age did, and protect our trees.

2.5 Changes in the Environment

As human needs increase, the pressure on natural resources increases. Along with population growth, urban development and industrial growth, the volume of waste also rises. If the solid waste generated in urban areas is not properly managed, it can affect soil, water and air alike. Segregating waste, recycling, reuse and proper waste management therefore play an important role in protecting the environment.

Changes in the natural environment directly affect human life and other organisms. Over-use of natural resources, deforestation, the degradation of water bodies, pollution and industrialisation reduce biodiversity. When habitats are destroyed, many plants and animals lose their natural homes, and the food chain and ecological balance change as a result.

Nature is seen not merely as a fixed force that determines human life, but also as a system that can be altered by human activity. Because human beings are part of nature, it is necessary to live in harmony with it rather than simply exploit it. Protecting natural resources, using water and soil sparingly, protecting forests, conserving biodiversity and controlling pollution form the basis of an ecologically sustainable life.

The natural environment is not only a resource for the present generation; it is also the fundamental asset for the livelihoods of future generations. Using natural resources according to need, without destroying them and with respect for their capacity to renew themselves, is therefore a key principle of sustainable development. Human progress and environmental protection are not opposed to each other; when development is undertaken with an understanding of the limits of nature, the two can be reconciled.

Table 1. Ecological knowledge of the five landscapes (aintiṇai)

Tiṇai (land)	**Season and time of day**	**Plants / crops**	**Animals / birds**	**Soil and water notes**
Kurinji (hills)	Kūtir (autumn) and muṉpaṉi (early dew); yāmam (midnight)	Kuriñci, vēṅkai; tiṉai (foxtail millet), hill paddy	Tiger, elephant, bear; peacock, parrot	Waterfalls, springs (cuṉai), hill slopes, millet clearings (puṉam)
Mullai (forest)	Kār (rainy season); evening	Mullai, koṉṟai, kāyā; varaku (kodo millet), mutirai (pulses)	Hare, deer; jungle fowl	Forest streams, small springs; monsoon, pasture
Marutham (cropland)	All six seasons; vaikaṟai (pre-dawn)	Marutam, lotus, kaḻunīr (blue water-lily); paddy	Buffalo, otter; stork, waterhen	River, pond (poykai), tank; silt, irrigation
Neithal (seashore)	All six seasons; eṟpāṭu (sunset)	Neytal, puṉṉai, ñāḻal	Shark; seabirds	Wide sands, backwaters (kaḻi), brackish water; salt

Tiṇai (land)	Season and time of day	Plants / crops	Animals / birds	Soil and water notes
Palai (transformed land)	Iḷavēṉil and mutuvēṉil (early and late summer), piṉpaṉi (late dew); midday	Pālai, iluppai	Enfeebled elephant, wild dog; vulture (eruvai)	Dried springs and rivers, wells (kūval); drought

3. Soil in the Five Landscapes

In Sangam literature, "soil" (*maṇ*) is not merely a land surface; it is an ecological identity that integrates the nature of a landscape, its fertility, water resources, plants, occupations and the life of its people. *Tolkappiyam* treats land as the "primary element" (*mutaṟporuḷ*) and describes four landscapes – *Kurinji*, *Mullai*, *Marutham* and *Neithal* – together with *Palai*, the land that arises when their character is altered.

Soil fertility is directly connected with human life. Soil is the foundation of agriculture, food production and plant growth, and preserving its natural character is essential for food security and ecological balance. Excessive use of chemicals in agriculture, soil erosion and changes in irrigation practices can all damage soil fertility; sustainable farming methods that conserve natural resources are therefore necessary. Fertile land and abundant water made the lives of the people prosperous.

The people of the Sangam age lived in harmony with nature, and so they lived prosperously, without want of food. Sami Chidambaranar writes:

> *"Two thousand years ago there was no famine in Tamil country. In the hills and forests, vegetables, fruits, tubers and honey were available in plenty. On the hill slopes and riverbanks, foodgrains such as millet, kodo millet and paddy grew beyond measure. Along the seashore, salt and fish lay without number. People happily cooked and ate grains and vegetables, as well as goat, pig, deer, monitor lizard, fowl and fish, and they took pleasure in drinking milk, curd and toddy." (Chidambaranar, 2009, p. 4)*

Food is the first necessity of human life. Realising its importance, the Tamils of the Sangam age took up agriculture and cultivated many kinds of crops. Ploughing was regarded as the occupation that sustains life. Thiruvalluvar affirms the pre-eminence of agriculture:

சுழன்றும் ஏர்ப் பின்னது உலகம்; அதனால்

உழந்தும் உழவே தலை

However it may turn, the world follows the plough;

so, toilsome though it be, farming is foremost.

— Thirukkural 1031

Marutham and *Neithal*, rich in fertile soil and water, were called *meṉpulam* (soft or fertile land), while *Mullai* and *Kurinji*, with poorer resources, were called *vaṉpulam* (hard land). Our ancestors excelled in agriculture, increased food production and lived prosperously.

Land is the primary source of food production, and crops yield well only when the land has fertile soil. In the Sangam age the land was divided into five types. *Tolkappiyam*, in its chapter on the poetics of love (*Akattiṇaiyiyal*), states:

மாயோன் மேய காடுறை உலகமும்

சேயோன் மேய மைவரை உலகமும்

வேந்தன் மேய தீம்புனல் உலகமும்

வருணன் மேய பெருமணல் உலகமும்

முல்லை குறிஞ்சி மருதம் நெய்தல் எனச்

சொல்லிய முறையாற் சொல்லவும் படுமே

The forest world dear to Māyōn̲, the world of dark-clouded hills dear to Cēyōn̲,

the world of sweet waters dear to Vēntan̲, the world of wide sands dear to Varuṇan̲ –

these are also named, in the order given, Mullai, Kurinji, Marutham and Neithal.

— Tolkappiyam, Porul. 5

- **Kurinji:** the hills and the land adjoining them, with slopes, rocks and hillsides.
- **Mullai:** the forest and the land adjoining it, a region rich in natural vegetation, where grazing and animal husbandry formed an interdependent environment.
- **Marutham:** fields and the fertile land around them, an agricultural region dependent on water; it reveals the relationship between water, fields and farming.
- **Neithal:** the sea and the sandy land beside it, in which the connections between beach sand, the sea and maritime life become clear.
- **Palai:** not a separate natural landscape, but the dry, impoverished state into which *Kurinji* and *Mullai* fall when their nature is altered.

3.1 Kurinji: Hill Soil

Kurinji comprises the hills and the regions around them. In the Sangam poems, natural features such as hill slopes (*cāral*), rocks, waterfalls and forest streams (*kāṉyāṟu*) are the hallmarks of this landscape. The soil of *Kurinji* is bound up with the natural structure of the hills; references to slope land, in particular, indicate the moisture, rainfall and vegetation of the hill country.

The natural richness of the *Kurinji* landscape, and scenes of deer and elephants roaming the red earth, are beautifully portrayed in Kapilar's *Kurinjippattu* and in *Akananuru*. The Sangam poets sang with finesse of elephants in hill country enriched by waterfalls and of deer frolicking on the red soil. It is trees that protect people from natural disasters such as landslides.

வளி பொரு மின்னொடு வான் இருள் பரப்பி

விளிவு இன்று கிளையோடு மேல்மலை முற்றி

நளி கடல் முன்னியது போலும் தீம் நீர்

வளி வரல் வையை வரவு

Spreading darkness across the sky with wind-struck lightning,

gathering ceaselessly with its kin upon the western hills,

the Vaiyai arrives with its sweet waters borne on the wind,

as though it were bound for the vast sea.

— Paripadal 12

The Vaiyai rises in the Pothigai hills. Although the Vaiyai rushes on like the sea, there are no reports of landslides; we learn from Sangam literature that no lives were lost even when the river was in flood.

On the hill ranges and slopes of Bhavani and Sathyamangalam, in the northern and north-western parts of Erode District, **gravelly and stony red soil** mixed with rock fragments and gravel is widely found.

Figure 1 relates the *Kurinji* ecology described in Sangam literature to the present-day landscape of Erode. Centred on the Thalamalai area of Erode District, this infographic explains the ecological knowledge of *Kurinji*, the land of hills and hillsides. Linking the literary setting with present-day field views, it highlights four key elements: water bodies, land, trees and settlement.



Figure 1. Ecology of the Kurinji landscape: Sangam literature and the present-day landscape of Thalamalai, Erode District (infographic; labels in Tamil)

3.2 Mullai: Forest Soil

Mullai is the forest and the land around it. In this landscape, forest, grassland, shrubs and trees were found together, and animal husbandry and grazing were part of its way of life. The soil of *Mullai* is therefore associated with a forest–pasture–livestock way of life.

Because red soil abounds in the *Mullai* landscape, Sangam literature calls its earth *cempulam* (red land). Just as rain falling on red earth mingles with it inseparably, loving hearts merge completely into one. This is seen in the *Kuruntokai* verse:

யாயும் ஞாயும் யார் ஆகியரோ?

எந்தையும் நுந்தையும் எம் முறைக் கேளிர்?

யானும் நீயும் எவ்வழி அறிதும்?

செம்புலப் பெயல் நீர் போல

அன்புடை நெஞ்சம் தாம் கலந்தனவே

What is my mother to yours? How is my father kin to yours?

By what path did you and I come to know each other?

Like rain poured on red earth,

our loving hearts have mingled into one.

— Kuruntokai 40

Of the upland soil and rock-strewn ground of the *Mullai* landscape, *Natrinai* says:

முரம்பு தலை மணந்த நிரம்பா இயவின்

ஓங்கித் தோன்றும் உமண் பொலி சிறுகுடி

On the unfinished path where the gravelly upland spreads,

the small hamlet bustling with salt-traders rises into view.

— Natrinai 374

Here *murampu* denotes upland ground mixed with pebbles and red soil. The line describes a settlement of *umaṇar* (salt traders) along a stony *Mullai* track. The scene of the rainy season after rain has fallen is evoked in another *Natrinai* verse:

ஈரச் செம்மண் ஈர்ம்புறத் தாரும்

... the wet red earth, damp upon its surface ...

— Natrinai 87

In this poem the poet Nannakanar finely describes the red earth of the *Mullai* landscape, soaked by the rains of *kār*, and the hero arriving in his chariot along it.

Soil of this type is found in the dense forests of Erode District, such as the Sathyamangalam Tiger Reserve.

- **Forest soil:** organically rich forest soil and brown soil, formed as fallen leaves and litter decompose into organic matter, are found in these forests.

Figure 2 connects these ecological features of the *Mullai* landscape with the field setting of Erode. Centred on the Noyyal area of Erode District, the infographic explains the traditional ecological knowledge and local ways of life of *Mullai*, the land of forests. It vividly depicts agriculture, water bodies, livestock grazing and the waiting of the *Mullai* heroine.



Figure 2. The Mullai landscape in Sangam literary ecology and the life of the Noyyal area, Erode District (infographic; labels in Tamil)

3.3 Marutham: Field Soil

Marutham is the land of fields and the land around them. Its basic distinction, therefore, is water and agriculture. Rivers, ponds, fields and irrigation are interwoven with its ecology. In Sangam literature, references to ploughing, paddy and open fields reveal the fertile soil and agricultural knowledge of the *Marutham* landscape.

The soil of *Marutham* consists of the rich alluvium of river basins and a moist, clayey land surface suitable for agriculture. Many lines in the *Marutham* poems speak of the richness of alluvial soil, the way farmers prepare the soil, and field earth that turns to mud as water flows over it. The richness of the alluvium is indicated by this line of *Natrinai*:

வண்டல் ஆயமொடு வண்டல் தைஇ

… shaping toys of silt with her band of playmates …

— Natrinai 143

It refers to the heroine playing with her friends using the rich silt deposited along the riverbanks of *Marutham*.

The character of *Marutham* soil, which farmers yoke their ploughs to, knead into mud and plant with paddy, is pictured in these lines of *Akananuru*:

மனை நடு மௌவலொடு மல்லிகை அவிழும்

வினை நவில் உழவர் …

… பல்லியம் கறங்க, மண் பிசைந்து

Where jasmine opens beside the mauval planted in the yard,

the ploughmen practised in their craft …

… knead the earth as many instruments resound.

— Akananuru 26

These lines describe skilled farmers, amid auspicious music, kneading the rich soil of the field into mud as they plough. Literature celebrates the ever-flooded, muddy fields of *Marutham* as *paḻaṉac cēṟu*, the mire of the paddy fields.

கழனி மாஅத்து விளைந்துகு தீம்பழம்

பழன வாளை கதூஉம் ஊரன்

The man of the town where the vāḷai fish of the pond

snatches the sweet ripe fruit that drops from the mango by the field.

— Kuruntokai 8

These lines of *Kuruntokai* point to the abundance of *Marutham* fields, where trees flourish on the moisture and water of the soil and their fruits fall into the ponds.

In the *Marutham* section of *Kalittokai* (*Maruthakkali*), the way in which the rich silt carried by fresh floods protects the land, and the fertility of the soil, are used as similes in stories of the hero's lovers' quarrels.

மலி புனல் வறண்ட மண் படு மருங்கின்

... on the banks where the brimming flood lays earth upon dry ground ...

— Kalittokai

This line indicates how, when the river rises, the soil on its banks is enriched and brings fertility to the fields. In the *Marutham* poems, soil is not regarded merely as ground; it is highly praised for its agricultural value – as *ceḻuñcēṟu* (rich mud) in which hunger-relieving paddy grows, and as *vaṇṭal maṇ* (silt) brought by the river.

In Erode District, this type of soil is found in the wetland (*nañcey*) areas irrigated by rivers and canals (the Bhavani, Cauvery and Noyyal rivers and the Kalingarayan canal).

- **Alluvial and red loamy soil:** alluvium deposited in the river basins, and the fertile red loam of areas such as Erode and Gobichettipalayam, are found in the field areas. They are suitable for crops such as paddy, sugarcane and turmeric.

Figure 3 visualises this agricultural ecology of *Marutham* in the field setting of Erode. Centred on Kallipatti in Erode District, the infographic illustrates paddy fields, land after harvest, irrigation channels, field-side settlements, trees and bunds (*varappu*). It also shows that agriculture, integrated with land, water, trees and local knowledge, is the livelihood of the people of this landscape.



Figure 3. Marutham landscape ecology: agriculture and local life in Kallipatti, Erode District (infographic; labels in Tamil)

3.4 Neithal: Coastal Sand

Neithal is the sea and the land beside it. The life of the *Neithal* people was bound up with the sea, sand, brackish water and coastal vegetation. The soil found here therefore reflects a coastal sandy environment distinct from agricultural soil.

Erode District has no coastline. However, the major rivers Cauvery, Bhavani and Noyyal flow through it. Along these riverbanks and in their surroundings, alluvial soil and reddish-brown sandy soil are found.

Small patches of alluvium occur along the banks of the district's main rivers, the Bhavani and the Noyyal. Formed from the fertile fine sediments carried by the rivers, this soil is very suitable for agriculture. At many places along the banks of the Cauvery and the Bhavani, reddish-brown sandy soil is found as a thin layer. Sand deposits are extensive where the rivers follow a meandering path. Because the riverbeds of Erode District generally consist of hard rock (charnockite gneiss), sand deposits are scanty along some stretches.

3.5 Palai: The Soil of Transformed Land

Palai has no landscape of its own. When *Kurinji* or *Mullai* loses its nature, its fertility declines and it becomes dry, it is called *Palai*. The evidence is these lines of *Silappatikaram*:

முல்லையும் குறிஞ்சியும் முறைமையில் திரிந்து

நல்லியல்பு இழந்து நடுங்குதுயர் உறுத்துப்

பாலை என்பதோர் படிவம் கொள்ளும்

When Mullai and Kurinji depart from their proper order,

lose their gracious nature and inflict trembling distress,

they take on the form that is called Palai.

— *Silappatikaram*

These lines show an ecological understanding that land is not fixed, and that its nature and character can change with climatic and natural change. Through them we perceive the Sangam ecological knowledge that soil, water, rain, plants, animals, occupation, food, settlement and the life of the people are all interconnected.

In the *Palai* landscape, women carried the silt dolls they had made and played with to the drinking ghat, to the sound of the horn:

வயிர் இடைப்பட்ட தெள் விளி இயம்ப,

வண்டல் பாவை உண்துறைத் தரீஇ,

திரு நுதல் மகளிர் குரவை அயரும்

As the clear call of the horn rings out,

bringing their silt dolls to the drinking ghat,

women of lovely brow dance the kuravai.

— Akananuru 269

This *Akananuru* poem notes that silt is found even in the *Palai* landscape. Because *Kurinji* and *Mullai* appear as *Palai* in summer, it is possible for the silt of *Mullai* to be found in *Palai* as well.

In Erode District, the dry upland areas are the rain-fed (*puñcey*) and elevated lands where rainfall is low (Perundurai, Kangeyam and parts of Bhavani).

- **Black soil and calcareous red soil:** across most of the district's uplands, dry red soil rich in lime (red calcareous soil) is found, with patches of clayey black soil that retains moisture for long periods.

4. Knowledge of Water in Sangam Literature and Water Management in Erode District

Water is the most important natural resource for human life. It is often pointed out that a large share of the world's population lacks sufficient clean drinking water and that obtaining safe drinking water is a major challenge in many places.

Population growth, urbanisation, industrial growth and the excessive use of water put pressure on water resources. When water bodies are polluted, not only human beings but also aquatic organisms suffer. Economy in the use of water and the protection of water bodies are therefore key components of environmental protection. Life on earth cannot go on without water, as Thiruvalluvar says:

நீரின்று அமையாது உலகெனின் யார்யார்க்கும்

வான்இன்று அமையாது ஒழுக்கு

If the world cannot exist without water,

then for no one can the order of life endure without rain.

— Thirukkural 20

4.1 Knowledge of Water in Sangam Literature

The knowledge of water in Sangam literature appears at many levels: its indispensability, the natural water cycle, the creation of water bodies, keeping water clean and using water for agriculture. The phrase **nīr inṟu amaiyā ulakam** ("the world that cannot be without water") itself conveys that water is essential to the life of all beings.

Today, many kinds of water bodies – lakes, ponds and canals – have been encroached upon and turned into houses and buildings. Yet the people who live in the hills still protect their water bodies. In the hills there are many forest streams, springs, pond water and waterfalls (Arimappamakan, 2017, p. 3).

That food production and life itself are possible only when water and land come together is made clear by this line:

உணவெனப் படுவது நிலத்தொடு நீரே

What is called food is land together with water.

— Purananuru 18

From this we learn that the Tamils of the Sangam age held the importance of water as basic knowledge for living.

4.2 Insight into the Natural Water Cycle

Sangam literature contains subtle observations of rain and the water cycle.

குணகடல் முகந்து குடக்குபு ஏர்பு இருளி

Having drawn from the eastern sea, rising westward and darkening …

— Natrinai 153

பாடுஇமிழ் பனிக்கடல் பருகி வலன் ஏர்பு

Having drunk of the cool, roaring sea, rising and wheeling to the right …

— Mullaippattu 4

Lines such as these describe clouds that draw water from the sea and pour it down as rain. Their close observation of the natural link of sea, cloud and rain reveals the knowledge of nature possessed by the people of the Sangam age.

Rain was understood not as a mere natural event but as a vital natural resource that sustains land, water bodies, agriculture and living beings. In the *Kurinji* landscape:

அண்ணல் நெடுங்கோட்டு இழிதரு தெள்நீர்

அவிர்துகில் புரையும் அவ்வெள் அருவி

The lovely white waterfall of clear water descending from the lofty peak,

like a shimmering length of cloth.

— Kurinjippattu 54–55

பழு மிளகு உக்க பாறை நெடுஞ்சுனை

முழு முதற் கொக்கின் தீங்கனி உதிர்ந்தென

Into the long rock-pool where ripe pepper has spilled,

the sweet fruit of the thick-trunked mango has dropped.

— Kurinjippattu 187–188

These lines refer to the presence of water bodies such as waterfalls and rock-pools (*cuṉai*).

4.3 Creation of Water Bodies and Water Management

Knowledge of water management – creating water bodies and storing water – is clearly recorded in Sangam literature:

நிலன் நெளி மருங்கின் நீர்நிலை பெருகத்

தட்டோர் அம்ம, இவண் தட்டோரே

Those who raised bunds so that pools would swell in the hollows of the land –

they, indeed, are the ones who have bound lasting fame here.

— Purananuru 18

Impounding water in low-lying land and enlarging water bodies was regarded as an act of public welfare. The poem also shows that creating water bodies and storing water for use on farmland was considered one of the principal duties of a ruler.

4.4 Keeping Water Clean

Knowledge of keeping water clean is also found in the life of the Sangam age:

கலம் சிதை இல்லத்துக் காழ் கொண்டு தேற்றக்

கலங்கிய நீர் போல் தெளிந்து நலம்பெற்றாள்

நல் எழில் மார்பனைச் சார்ந்து!

Like muddied water made clear by the clearing-nut

in a house of broken vessels, she grew clear and regained her beauty

on reaching the man of the handsome chest!

— Kalittokai 142

Here the heroine regains her clarity just as turbid water is cleared with the clearing-nut (*tēṟṟāṅkoṭṭai*, *Strychnos potatorum*). Similarly, accounts of using *nelli* (Indian gooseberry) roots in wells with brackish water and of growing *nelli* trees on the banks of village drinking ponds (*ūruṇi*) point to nature-based practices for improving water quality.

The belief that deities dwell in water bodies may also have served, through social norms, to keep them clean. Beliefs about deities associated with water bodies in works such as *Ainkurunuru* and *Akananuru* suggest this. Belief, social order and water protection may thus have been interlinked.

4.5 Water Management in Erode District

Today many urban water bodies face pollution. The later practical continuity of the water knowledge found in Sangam literature can be compared with irrigation systems of Erode District such as the Kalingarayan canal.

4.6 Features of the Kalingarayan Canal

The Kalingarayan canal draws water from the Bhavani River and carries it as far as the Noyyal river area.

- **Difference in elevation:** about 534 feet above sea level at its head and about 412 feet at its tail.
- **Design:** although the straight-line distance is about 50 km, the channel winds for **about 90 km**, using gravity and curves to regulate the flow of water.

- **Use:** this layout controls the velocity of the water and allows the land on both sides of the course to use it; irrigation water is also shared through many sluices for the benefit of farmland.
- **Period:** according to inscriptional evidence, the construction of the canal began in 1270 CE and was completed in 1282 CE.

4.7 Other Reservoirs and Continuity

Reservoirs of Erode District such as the Bhavanisagar, Kodiveri, Varattupallam and Gunderipallam dams are water-management systems that store water and supply it for agriculture and public use.

Rather than asserting that these are direct continuations of the water-management methods mentioned in Sangam literature, they may be regarded as later practical expressions of a long-standing Tamil ecological knowledge of storing water, distributing it and using it in conjunction with agriculture.



Figure 4. Water bodies of Erode: an ecological map of dams, water distribution and agriculture (infographic; labels in Tamil)

5. Climate

On climate change, the ecologist K. Kunarasa writes:

> *"Evaporation from the earth's surface will take place on a large scale. Severe summers will persist in some parts of the world. Winds that once blew gently will begin to blow as storms. The hydrological cycle will be disturbed. Changes will occur in the salinity of sea water and in the state of fresh water. As ocean temperatures rise, the rock beds of the ocean will become unstable, releasing methane into the atmosphere. Methane trapped in accumulations of ice will also escape and enter the atmosphere." (Kunarasa, 1997, p. 19)*

Many scholars expressed views about climatic change many years ago, and what they foresaw is now happening before our eyes.

Scholars state that the effects of El Niño and "super El Niño" are now causing major changes in the climate. Reduced rainfall has caused drought in many districts, and forecasters predict that rainfall will increase in many

districts in the coming years. Weather forecasters have said that in late 2026 and 2027 many districts of Tamil Nadu will suffer severe drought, while many others will face destruction from excessive rain. Even in the Sangam age, when technology and artificial intelligence had not developed, the thinkers of the time possessed knowledge of climatic change; observation of the seasons held an important place in the Sangam Tamils' knowledge of nature.

5.1 The Major Seasons of Tolkappiyam and Their Record in Sangam Literature

In the *Tolkappiyam* tradition, the year is divided into six major seasons (*perumpoḻutu*): *kār*, *kūtir*, *muṉpaṉi*, *piṉpaṉi*, *iḷavēṉil* and *mutuvēṉil*. In Sangam literature these are recorded not merely as divisions of time but as seasonal markers that identify natural changes such as rain, cold, dew, heat, wind and the flowering of plants. A *Kuruntokai* poem by Okkur Masathiyar records the rains of *kār* beautifully:

பெயல்புறந் தந்த பூங்கொடி முல்லைத்

தொகுமுகை இலங்கெயிறு ஆக

நகுமே தோழி நறுந்தண் காரே

With the clustered buds of the flowering mullai vine, nurtured by the rain,

for its gleaming teeth,

the fragrant, cool rainy season is laughing, my friend.

— Kuruntokai 126

As a result of the rain, buds appear on the *mullai* vine, and to the heroine they look like smiling teeth. The poet thus finely records the natural sequence of rain, plant growth and flowering.

5.2 Knowing the Seasons through Living Beings

Sangam literature identifies the arrival of the season of *iḷavēṉil* (early summer) by the flowering of plants and the activity of birds and animals. The flowering of plants such as *kuruntam*, *mullai* and *koṉṟai* and the dancing of peacocks are mentioned as natural signs that *iḷavēṉil* has come. This shows that seasonal change was known not only through measures such as temperature but also through the behaviour of living beings and the growth stages of plants.

Natural elements such as clouds, rain, wind, thunder, lightning, dew and sunshine are recorded throughout Sangam literature. It is noteworthy that the arrival of rain is linked with natural signs such as the gathering of clouds, changes in the wind, the sound of thunder and changes in plants.

Sangam climatic knowledge, therefore, is not a calendar based on particular months; it may be regarded as ecological knowledge that identifies the season through continuous observation of natural events.

5.3 The Present Climate of Erode District

Erode District lies in the Western Agro-climatic Zone of Tamil Nadu. Although the district generally has a dry climate, significant variations occur during the monsoon seasons.

According to the district administration:

- The first two months of the year (January–February) have relatively pleasant weather.
- Heat increases from March to May.
- Some climatic change is seen during June, July and August.
- The north-east monsoon brings heavy rain in October, November and December.

According to agro-climatic data, rainfall is as follows:

- **South-west monsoon (June–September):** 270 mm on average
- **North-east monsoon (October–December):** 319 mm on average
- **Winter:** 44 mm
- **Summer:** 139 mm
- **Average annual rainfall:** 772 mm

Tamil Nadu Agricultural University (TNAU) gives the normal annual rainfall of the district as about 717 mm. It should therefore be borne in mind that rainfall figures used in research may vary with the period, the recording station and the source.

Rainfall is not uniform across Erode District. The district administration notes that higher rainfall is recorded in the Gobichettipalayam and Bhavani taluks, whereas many interior parts of the district are relatively dry. To understand the climate of Erode, therefore, block-level variations in rainfall must also be taken into account.

5.4 Sangam Seasons and the Agricultural Seasons of Erode

In Erode's agricultural life, seasonal change directly determines sowing, the choice of crops, irrigation and harvest. According to TNAU's agrometeorological information, knowledge of the amount, distribution and intensity of rainfall is important for agricultural decisions such as the time of sowing, irrigation schedules and the time of harvest.

Local agricultural calendars used in Erode, such as *paṭṭam* (sowing seasons), can be studied alongside this. For example, it is necessary to confirm through farmer interviews and fieldwork which crops local seasonal practices such as *āṭippaṭṭam* (the sowing season of the month of Āṭi) are actually used for, and with what rainfall or soil-moisture conditions in mind. Rather than equating these directly with the six major seasons of Sangam literature, it is methodologically appropriate to compare them at the general level of knowledge that recognises seasonal change from natural signs.

A comparison of Sangam seasons and the present climate of Erode

The six major seasons of Sangam literature:

- **Kār:** rain; *mullai* buds blossom
- **Kūtir:** coolness
- **Muṉpaṉi:** dewfall
- **Piṉpaṉi:** seasonal transition
- **Iḷavēṉil:** flowering; rising heat
- **Mutuvēṉil:** intense heat; drought

The present seasons of Erode District:

- **March–May:** high heat
- **June–September:** south-west monsoon
- **October–December:** north-east monsoon (rainfall concentrated in October–November)
- **January–February:** relatively pleasant weather

6. Plants

In Sangam literature, plants do not appear merely as objects of natural scenery. They are associated with the identity of each *tiṇai*, the natural character of the land, and the life, food, occupations, medicine and ecological knowledge of the people.

In the *Tolkappiyam* tradition, the "native elements" (*karupporuḷ*) of each *tiṇai* – deity, people, animals, plants, occupation and so on – are related to one another.

6.1 Plants of the Kurinji Landscape

In Sangam literature the *kuriñci* flower appears in many places as the natural emblem of the hill country. By listing the many flowers and plants found in the hills, Kapilar's *Kurinjippattu* reveals the botanical outlook of its time. The long list of flowers in *Kurinjippattu* is excellent literary evidence that the ancient Tamils observed hill plants individually and knew their flowering, colour, fragrance, season and habitat. Bamboo, too, abounds in the hills, as these lines show:

கருவிரல் மந்திக் கல்லா வன்பார்ப்பு

இருவெதிர் ஈர்ங்கழை ஏறிச் சிறுகோல்

மதிபுடைப் பதுபோலத் தோன்றும் நாட!

O man of the land where the untaught, sturdy young of the black-fingered monkey,

climbing the green stem of the great bamboo,

looks as if it were striking the moon with a little stick!

— Ainkurunuru 280

(In this poem *īrṅkaḻai* denotes green bamboo.)

Comparison with Erode District

In Erode District, hill areas such as Sathyamangalam, Thalavadi, Asanur, Thimbam, Kadambur and Kermalam merit comparative study with the natural setting of the *Kurinji* landscape.

Because the Sathyamangalam Tiger Reserve lies where the Western Ghats and the Eastern Ghats meet, it has diverse plant resources: grasses, shrubs, climbers and many kinds of trees, as well as many recorded grasses and medicinal herbs.

6.2 Plants of the Mullai Landscape

The emblematic flower of the *Mullai* landscape is the *mullai* (jasmine). The Sangam poets linked the flowering of the *mullai* vine with the seasons:

பெயல்புறந் தந்த பூங்கொடி முல்லைத்

தொகுமுகை இலங்கெயிறு ஆக …

With the clustered buds of the flowering mullai vine, nurtured by the rain,

for its gleaming teeth …

— Kuruntokai 126

Here the buds that appear on the *mullai* vine after the rain are mentioned, revealing the poet's careful observation of the natural sequence of rain, plant growth and flowering.

Comparison with Erode District

The forests of Sathyamangalam, Bhavanisagar, Thalavadi, Thalamalai, Asanur, Kadambur and Anthiyur are suitable areas for studying the plant wealth of the *Mullai* landscape. The Sathyamangalam reserve contains a range

of habitats, from dry thorn forests to dry deciduous forests, moist deciduous forests and some semi-evergreen formations.

6.3 Plants of the Marutham Landscape

The *marutam* tree (*Terminalia arjuna*) is named as the emblematic tree of the *Marutham* landscape. Agriculture and crops such as paddy, sugarcane and banana are also associated with life in *Marutham*.

In Sangam literature, "*Marutham*" is itself the *tiṇai* name for fertile fields and wetland areas. Sangam literature shows that the plants of *Marutham* are bound up with its water, soil and agriculture.

Comparison with Erode District

In Erode, the plants of *Marutham* and agricultural crops can be seen in the areas around the Cauvery, the Bhavani and the irrigation canals.

Horticultural crops are cultivated over a considerable area in the district. The district administration lists turmeric, banana, jackfruit, mango, guava, tapioca and vegetables as major crops. Turmeric is a leading agricultural emblem of Erode. A study of *Marutham* in Erode can therefore integrate four elements: soil, water, crops and people's livelihoods.

6.4 Plants of the Palai Landscape

Palai is not inherently a separate landscape. Literary tradition regards *Palai* as the state in which *Kuriṉji* and *Mullai*, parched by fierce sun, lose their natural condition and appear as dry land. In understanding *Palai* plants, therefore, drought-tolerant plants, thorny scrub, small shrubs and grasses may be considered.

Comparison with Erode District

Official documents state that dry thorn forests and dry deciduous forests occur in the Sathyamangalam Tiger Reserve of Erode District.

The idea of drought and vegetation change associated with *Palai* in Sangam literature can therefore be examined through fieldwork in the dry areas of Erode. Drought-tolerant local plants, thorny scrub and grasses can be seen in Sathyamangalam, Anthiyur, Thalavadi, Thalamalai and the dry interior areas of the district.

6.5 Plants of Erode District: A Tiṇai-Based Classification

The landscape of Erode District can be compared with the *aintiṇai* plant scheme of Sangam literature as summarised in Table 2.

Table 2. Plants of Erode District classified by tiṇai

Landscape	Areas of Erode	Plant types found
Hills (Kurinji)	Thalavadi, Asanur, Thimbam, Kadambur, Bargur	Hill plants, grasses, medicinal herbs, climbers
Forest (Mullai)	Sathyamangalam, Bhavanisagar, Thalamalai, Kermalam	Deciduous trees, shrubs, climbers, medicinal herbs
Fields (Marutham)	Bhavani, Gobi, Sathyamangalam, Noyyal–Cauvery irrigated areas	Paddy, turmeric, banana, sugarcane, marutam trees and others
Dry areas (Palai)	Anthiyur and the dry interior of the district	Thorny scrub, drought-tolerant grasses, shrubs, local trees
Riverbanks / water bodies	Banks of the Cauvery, Bhavani and the canals	Aquatic plants; locally used plants such as marutam and nelli

7. Animals

Sangam literature reveals that animals were very closely bound up with the life of the people of the Sangam age. Aquatic animals, land animals, domestic animals and wild animals are interwoven with both the inner (*akam*) and outer (*puṟam*) ecology of Tamil life. Animals held an indispensable place in war and in travel; in the social ecology of the time they were also an important source of food. Sangam records refer extensively to the keeping of animals in homes and to the place of animals in rituals and beliefs.

In the Sangam age, a way of life prevailed in which no movement was possible without the help of animals. On how people fought and died among themselves over animals, V. Perumalsamy writes: "In the Sangam age, wars over cattle were frequent among the peoples of the *Kurinji* and *Mullai* lands of Tamil country. Sangam literature refers to the wars of that time as *veṭci* and *karantai* wars" (Perumalsamy, 2009, p. 50). In the Sangam age, seizing herds of cattle in war was regarded as a mark of valour.

7.1 Knowledge of Animal and Bird Behaviour in Sangam Literature

In Sangam literature, animals and birds do not appear merely as objects of natural scenery. They are recorded as emblems of the *tiṇai* setting, as natural indicators of season and time, and as beings bound up with human life. The Sangam poets closely observed the animals and birds suited to the natural setting of each landscape.

குக்கூ என்றது கோழி; அதனெதிர்

துட்கென் றன்றென் தூய நெஞ்சம்

தோள்தோய் காதலர்ப் பிரிக்கும்

வாள்போல் வைகறை வந்தன்றால் எனவே

The cock cried "kukkū"; at that,

my pure heart shuddered,

for dawn has come like a sword

that severs lovers locked in embrace.

— Kuruntokai 157

In this poem the crowing of the cock serves as a natural sign announcing the arrival of dawn (*vaikaṟai*). It shows that knowledge of reckoning time from the natural activities of birds existed in Sangam life. Likewise, there was a practice of recognising natural changes and environmental conditions from the behaviour, calls, movements and habitats of animals.

On the subtle behaviour of animals, the following poem is evidence:

ஆயிடை வாடல்கொல்லோ தாமே – அவன் மலைப்

போருடை வருடையும் பாயா

சூருடை அடுக்கத்த கொயற்கு அருந் தழையே?

Will they wither in the meantime – the leaves so hard to pluck

on the god-haunted slopes of his hill,

where even the fighting mountain goat will not leap?

— Natrinai 359

The poem mentions that the mountain goats (*varuṭai*) keep away from the foliage of a hill where *cūr* (a deity, or dread) dwells, without eating it. It shows how beliefs about the nature of particular places and the behaviour of creatures arose. Examined from an ecological perspective, it reveals the relationship between animal behaviour, habitat, human belief and protection.

7.2 Animals of Erode District

Erode District is rich in faunal diversity. The Sathyamangalam Tiger Reserve lies in an important ecological corridor where the Western and Eastern Ghats meet. Official records of the reserve list many species, including elephant, tiger, leopard, dhole (wild dog), hyena, gaur, four-horned antelope and sambar. Among the deer, the spotted deer, sambar and barking deer (muntjac) are noteworthy. Elephants are important animals in the forests of Erode. Current official information from the Sathyamangalam Tiger Reserve gives:

- **Number of elephants:** about 651
- **Number of tigers (2024–25 camera-trap survey):** 112

These figures relate to the area within the tiger reserve boundary and should not be taken as the total animal population of the whole of Erode District.

7.3 Animals and People in Erode

The movement of animals into farmland adjoining the forests brings them into direct contact with people. Elephants entering farmland, wild boar damaging crops and, in some places, deer eating crops are important challenges in human–animal relations. Reducing human–wildlife conflict is named as a major management objective in the conservation plans of the Sathyamangalam Tiger Reserve.

7.4 Impacts of Human–Animal Conflict and Its Ecological Significance

7.4.1 Impacts

- Damage to crops and economic loss for farmers.
- Safety challenges arising from the movement of wild animals at night.
- Resource competition between domestic livestock and wild animals.
- Human–animal conflict in settlements adjoining forest areas.

7.4.2 Ecological significance

Speaking only of the challenges that animals pose to people is not a complete ecological perspective. Animals contribute vitally to ecological balance, the food chain, seed dispersal, plant reproduction and the natural functioning of forest resources.

For example:

- **Herbivores** take part in the natural cycle of plant growth.
- **Carnivores** help to keep the numbers of prey species in balance.

The conservation plan of the Sathyamangalam reserve also points out that a rich prey base is the foundation for the survival of large carnivores.

7.5 Birds: A Biological Component of Erode

The Vellode Bird Sanctuary in Erode District is a notable waterbird habitat. According to the district administration, it is a sanctuary of 77.185 hectares in Perundurai taluk. Migratory birds from many countries and

regions of the world visit it, and the sanctuary lake is also an important source of water for the surrounding farmland.

This can be examined in comparison with the knowledge found in Sangam literature of "knowing time, season and land through birds". However, rather than claiming that the present bird visits at Vellode are a direct continuation of Sangam records, it is more appropriate to compare them on the general ecological basis of "knowledge that observes nature through the behaviour of living beings".

8. Local Knowledge of Erode

When the knowledge of Sangam literature is set against the landscape of Erode, landscapes corresponding to the five *tiṇai* and their ecological knowledge can be identified.

Because Erode is a landlocked district, the *Neithal* landscape does not occur here directly. Nevertheless, the sandy environment denoted by the *Tolkappiyam* phrase "*perumaṇal ulakam*" (the world of wide sands) may be seen by analogy in river sandbanks and reservoir shores. This, however, cannot be treated directly as the *Neithal tiṇai*.

8.1 Local Knowledge of Erode: A Tiṇai-Based Comparison

Table 3. Local knowledge of Erode compared by tiṇai

Tiṇai	Corresponding landscape in Erode	Expected local knowledge	Method of verification
Kurinji	Northern hills and forest areas	Millet cropping in hill villages; collection of honey and medicinal herbs; knowledge of wildlife warnings	Vegetation sample plots; forest department data
Mullai	Grazing lands and scrub forest where forest meets plain	Grazing routes; seasonal grazing calendar; plant markers	Grazing maps; plant lists; interviews with herders
Marutham	Cauvery, Bhavani and Noyyal irrigated areas	Rules for sharing irrigation water; maintenance of canals and sluices; cropping of paddy, banana, sugarcane, turmeric and others	Irrigation maps; water and soil testing; irrigation office records
Neithal	*Analogy only:* river sandbanks, reservoir shores	River fishing; use of sandbanks; signs of floods	River fisheries records; comparison with flood indicators
Palai	Rain-shadow areas; dry and degraded forest margins	Drought-season crops; water storage in wells and ponds (*kuṭṭai*); drought-tolerant plants	Comparison of rainfall and groundwater data; degree of informant consensus

8.2 Fieldwork and Documentation

In fieldwork, each element of knowledge is recorded on a single form, so that the literary evidence, the local record and the scientific verification are brought together in one place. A model form, used to document local terms (including Kongu Tamil usage) and to verify an example record drawn from literature (the clearing-nut), is given in Table 4.

Table 4. Field documentation and scientific verification form (model)

Field	Information to be recorded	Example entry (literary basis)
Record number	Research code	ERD-TEK-001
Literary evidence	Text, poem number, line; type (observation / tradition / belief)	*Kalittokai* 142; clearing of turbid water with the clearing-nut seed
Tiṇai / domain of knowledge	Aintiṇai; soil – water – season – plant – animal	Marutham; water
Local name / usage	Informant's terms (with audio recording)	To be recorded in fieldwork
Place / GPS	Village, taluk, coordinates	To be recorded in fieldwork
Informant code	Occupation, age range, consent status	To be recorded in fieldwork
Scientific verification	Species, botanical name, measurement, result	Species: *Strychnos potatorum* (hypothesis)
Access status	Open / restricted / community only	To be decided after community consent

9. Traditional Knowledge and Present-Day Degradation

The *aintiṇai* ecological knowledge recorded in Sangam literature is a knowledge of living that interrelates land, water, plants, animals, climate and agriculture. In today's conditions, however, these traditional ecological systems are being altered and degraded for many reasons.

The researcher N. Murugesapandian points out that in present-day Tamil Nadu the *Kurinji* areas are being converted into commercial plantation estates and the fertile, silt-laden *Marutham* lands into residential areas, and that the Noyyal River has been polluted and turned into a channel for sewage (Murugesapandian, 2017). Because the Noyyal lies in the Erode region connected with the Kalingarayan canal, these ecological changes, the researcher M. Pandiyarajan argues, bear directly on the study setting of Erode District (Pandiyarajan, 2016).

Such views, however, should not be accepted merely as literary or opinion-based statements; they need to be verified scientifically through fieldwork.

In particular, these forms of degradation can be measured accurately by studying:

- water-quality analysis of the Noyyal and its associated water bodies;
- maps and satellite images (GIS and satellite imagery) recording changes in land use;
- changes in the extent of agricultural land; and
- changes in plant and animal resources.

In this way it will be possible to determine which of the ecological relationships among land, water, living beings and people in the Sangam age still continue, which have changed and which have been completely severed.

Aintiṇai ecological knowledge is therefore not merely a literary idea that recounts past glory; it is an important research tool for identifying present-day ecological degradation, assessing its causes and changes, and exploring opportunities for ecological restoration based on traditional ecological knowledge.

10. Conclusion

The *aintiṇai* theory of Sangam literature reveals the traditional knowledge of the Tamils, who understood land not as a mere geographical formation but as an integrated ecological system in which soil, water, climate, plants, animals, occupations, food and human life are all interconnected.

- the hill soil and plant and animal wealth of **Kurinji**;
- the forest and pastoral environment of **Mullai**;
- the fertile soil–water–agriculture system of **Marutham**;
- the aquatic and sandy environment of **Neithal**; and
- the drought and land transformation of **Palai**

together record, in fine detail, the workings of nature and its changes.

When these elements of knowledge are compared with the hill and forest areas of Sathyamangalam and Anthiyur, the river-irrigated areas of the Cauvery, Bhavani and Noyyal, the farmland, the dry uplands and wetland environments such as Vellode in Erode District, both the continuity of certain forms of natural knowledge and ways of life and contemporary changes – land-use change, degradation of water bodies, decline in soil fertility, habitat change and threats to biodiversity – come to light.

In particular, since the *Neithal tiṇai* does not occur directly in Erode District and its elements can be approached only by analogy with river sand and water-body environments, it becomes clear that the literary *tiṇai*s should not be mapped directly onto the present landscape but approached scientifically on the basis of their ecological components.

The traditional ecological knowledge recorded in Sangam literature is therefore not only literary information that explains past ways of life; it is a scientific and cultural resource that can help us understand present ecological change, document local knowledge traditions, protect soil, water and biological resources, and develop sustainable ways of living in harmony with nature.

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Use of Artificial Intelligence Tools

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