

ENVIRONMENT AND ECOLOGY IN THE *RĀMĀYANA*

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Human ties with Nature were deeply felt in ancient times and the idea on ecological balance of a place in a period is revealed by its flora, fauna and water elements. Reflections on supremacy of Nature abound in various literary texts. Vālmiki's *Rāmāyana*, a work of second century AD, is one such composition having two major episodes: Rāma's fourteen years' exile in forests, particularly Dandakāranya, and rescue of Sītā abducted and kept captive in Laṅkā, illustrate this point. The entire narration covers a wide area from Ayodhyā to Laṅkā and gives an elaborate account of different landscapes with descriptions of biological and non-biological phenomena.

The paper highlights the ecosystem of the major forests, and how mountains and rivers played a prominent associated role in the system.

Key words: Alpine region semi-forest system, *Aśrama*, Citrakūṭa Forest, Citrakūṭa Hill, Dandakāranya forest, Deciduous tropical forest, Evergreen Laṅkān forest, Ecological character, Flaura, Fauna, Mandākini river, *Oṣadhi* mountain.

INTRODUCTION

Ecology is the scientific study of the interrelations between living organisms and their environment, including both inter-specific and intra-specific relations. Human ties with Nature is an age old phenomenon and the idea of ecological balance of a particular place in a period may be discovered from its flora, fauna and water elements. In present day context this relationship is taken as 'religious ecology' which draws attention to kinship with the dependence on nature for necessities of life.¹

Vālmiki's *Rāmāyana*, a work composed between 2nd century BC. to 2nd century AD., is one of the early Indian composition which has strong overtone on supremacy of Nature. It spins on two major events: Rāma's fourteen years'

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exile in forests, particularly Dāṇḍakāranya, and rescue of Sīṭā kept captive in Laṅkā from the hold of Rāvaṇa. The entire narration referred to a region from Ayodhyā in UP to Central India, extending to Southern India, covering mostly central eastern parts, and finally to Laṅkā beyond sea. Obviously, narration of the landscapes is vivid in their descriptions of biological and non-biological phenomena.

The paper intends to throw light on three major eco-systems of Tropical Deciduous Forest, Alpine Region Semi-forest, particularly Himalayan, and the Evergreen Tropical Forest of Laṅkā with details of geographical distributions, principal floras and faunas, water elements, and environmental importance etc. This of course reflects that apart from forest, mountain and river played also a prominent associative role in the ecosystems in the landscape analysis. Lists of forest plants, animals and birds are also appended to have a summarized information on flora and fauna.

There are many technical terms which create confusion and need a little clarification. The words, *vana* and *aranya* are the common terms appearing to be synonymous in usage. The term *vana* is used also in the sense of a thicket, clustering of desirable plants in a place, etc. and thus signifying "sub-forestation". The term *aranya* etymologically means "wilderness", "uncultivated and uninhabited land", "distant or remote place". Characteristics of *aranya* or forest are thus reflected in its meaning itself. Other distinctiveness of forest lies in land-surface, bio-diversity, vegetation, degrees of wilderness, etc. The intensity of wilderness is emphasized by Rāma in his warnings to Sīṭā of the dangers of forest, like, lions, snakes, scorpions, thorn trees and vigorous blows of wind passing through the forest trees.² Rāmā's description giving a general idea about forest, is silent about the way-farer lost in the forest as referred to *Rgveda* (X.146) in the hymn of *Aranyakī* and the horrific and cannibalistic Rākṣas occupying a larger area of the Dāṇḍaka forest. Rāma, of course, took a vow to save them from these elements.

The forest, in general, is described in the *Rāmāyaṇa* as *sānta* (tranquil), *madhura* (sweet), *raudra* (fury) and *vibhatsa* (terror). These categories reflect as four *rasas* or sentiments which predominate the entire forest environment.³ The first two represent the atmosphere in the hermitages and the other two are more or less the associative factors of wilderness. As regards forest locals it

will not be out of place to mention that the forest was never devoid of human habitants (i.e. tribals). Firstly forest was the place for persons in *vānaprastha* stage of life. Secondly it was a place for ascetics' *āśramas* for spiritual activities. The *Rāmāyaṇa* also describes some particular human groups, like *Kinnaras* and *Vidyādharaṇas* as inmates mostly of Citrakuṭa forest. They are locals in the Rṣyamukha hill region and are believed by some as one type of tribal communities.

Forest type likewise were of two types: forest and sub-forest. The Citrakuṭa and Daṇḍakāraṇya belong to second type while Pañcavaṭi, Nīlakānana which developed within the stretch of the principal forest. Nīlakānana stretched on the bank of river Yamunā, having its own ecology with particular vegetation and animal types.⁴ Sometimes rows of such forests having no special sylvan characters are found within the forest area. Numerous such forests were crossed by Rāma during his long journey.⁵

TROPICAL DECIDUOUS FOREST

Our principal discussion centers round the tropical deciduous forests like Citrakuṭa, Daṇḍakāraṇya occupying a major part in Vālmiki's narration of Rāma's journey in exile. The Pañcavaṭi, though a sub-forest of Daṇḍakāraṇya has been given a special attention to bring into light the distinctness noticed in the ecology of forest itself and of *āśrama* or forest in modified ecology.

The forest landscape includes water element, in forms of river, lake, streams, pond, aquatic plants like, lotus and water lilies, and aquatic birds of different types either frequenting the bodies of water, or the shore. The forests in India are generally deciduous, and water is a central element in the ecology of the tropical deciduous forest.⁶ Continuous flows of water either from waterfall or hill-river or spring help the forest to maintain its moisture content. Forest and streams are interdependent. The thick forest acts as a conserving element in the hydrological cycle from which dry-season flow of water in stream continues. And the streams flow more clearly during heavy rain due to the influence of south-west monsoonal rain.⁷

Seasonal Impact:

Certain ecological changes happen to take place with the changes of season. These are noticed in vegetation, in birth of several species of insects, in

animal behaviour and in climatic and atmospheric changes. The forest landscapes change with three major seasonal changes during rain, winter and spring, the highlights of some of prominent changes in wood-land are:

In Rain: There are:

- i) Climatic and atmospheric changes, like, coolness in air and making it dust-free.
- ii) Vegetation frequent around the spot of water: *Kadambas, Sarjas, Arjuna*, etc. with peacock around.
- iii) Grasses getting moistures from rain show frequency of rain-associated red insect, *indragopa*.
- iv) Juice storing activities of bees from flower and fruit trees.
- v) Animal behaviour manifested in the great urge for mating.
- vi) Frequency of frog and some rain-associated birds.

The central point of the entire environment lies in spontaneity of life of and water is the central element in the entire change.

In Winter: Impact of winter on forest ecology is equally notable. These are explicit in the fog and mist stricken gloomy appearance of forested region, river-water evolved with fog and trees go without blossoms. But the forest grain-lands described as full of ripe grains, viz. barley, wheat and *sāli* rice and rejoice with *Krauñca* and *Sārasa* in dancing mood in the midst of these fields possibly for collection of food particular to the fields. Dew-fall supplies water elements to sandy river bank.⁹

In Spring: Efflorescence of several trees like *Kimsuka* (*Butea frondosa*) gets a scenic presentation in the description of Citrakuta forest, a common feature of Madhya Pradesh forest till today. Marking nut tree (*bhallālāka*) and *bel* were the other vegetation reported here. On the whole, an enliven phenomenon in nature is reflected.¹⁰

Citrakuṭa Forest and Citrakuṭa Hill:

Citrakuṭa forest is distinguished as non-wild in its entire stretch of extension, though wild animals are frequently mentioned. An atmosphere of

purity and spirituality has been reflected in Vālmīki's description. Wilderness however is absent in the portrayal of natural surroundings of the two associating ecosystems of the forest ecology, the hill Citrakuṭa and the river Mandākinī. Everywhere the terms *ramya*, beautiful or pleasing, and *sutīrtha* or *punya* i.e. spiritual abode are noticed. Obviously these two attributed, as ecological companionship, transmitted to the forest environment also. Thus we find Bharadvāja advising Rāma to settle in Citrakuṭa forest in the first phase of life in exile. It is also known as *mahāvana* or great forest.

It is located in the distance of ten *krośas* from Prayāga (Bharadvāja *āśramas*) and is found to have its growth in the canvas of two ecosystems: Citrakuṭa hill and river Mandākinī. Thus the *Rāmāyana* states¹¹: "This is Citrakuṭa and the river Mandākinī flows at its feet. The stretch deep into forest-dense like cloud". Again: "About three and half yojanas (i.e. 5 miles) from this place there is a hill called the Citrakuṭa in the midst of deep forest. Its woods and streams are quite pleasant". The statements are no doubt highlighting forest-growth encircling the mountain. In another instance growth of the forest on the foot-hill plain is clearly stated.¹² "We will roam happily in the forest on the foot-hill plain (*samabhūmitala*), which is pleasing, sacred and densely covered with trees of different types".

In furthering the ecology of the forest the *Rāmāyana* states¹³: "The river Mandākinī flows on the north of this mountain. The forest, which grow here and there by its sides, are beautiful and covered with flowering trees". River-side growth of forest gets full focus in this description. Both the phenomena are presented with their respective ecosystems consisting of flora, fauna, water elements and other elements of importance. The forest ecology, derived from the landscape presentations, however, is an intermingling of the three systems, i.e. hill, river and its own, inseparable to a great extent. In the ecological study an enumeration of natural phenomena of the hill and the river is necessary.

The Citrakut, a hill is beautiful and resembles Gandhamādana hill having a nature fostering spiritual environment characterized as a repository of diverse bio-phenomena, rich water resources, inclusive of water-fall, rivulet and fountain, mineral deposits, forest locals particular thereto and other ecological elements. The details may be found in Vālmīki's graphic account of the hill and its table land.¹⁴ As regards mixed vegetation of edible and non-edible types, the

former includes fruit trees, like, mango, bel, jack-fruit, jujube, myrobalan and a type of sour-fruit (*bhavya*). The latter includes a host of diverse plants covering:

- a) Flowering trees, like, *lodhra*, *nīpa*, *tilaka*;
- b) Tall hardwood trees of dry deciduous forest, some of which are particular to central and southern India. These include — *aris̄ta*, *asana* or *bijaka*, *dhanvana*, *madhūka*, *tiniśa* and *varaṇa*;
- c) Grass type — *veṇu* and *vetra*;
- d) Five *oṣadhis* (textual statement is “*oṣadhis* glowing at night” which indicates “*mahausadhis*”, five in number in Ayurvedic concept and comprise of *s̄vetakanṭakāri* (*Salanum xanthocarpum*), *Brāhmī* (*Herpestis monniera*), *Kaṭuka* (*Gentiana kuroo*), *Ativisā* (*Aconitum heterophyllum*) and *Hilamocika* (*Euhydra hincha*).

Most of the trees reported above, apart from their other values, possess medicinal properties which make the environment congenial for forest habitation.

Faunal Character: Bio-diversity is likewise noticeable in faunal character, wild and non-wild. Elephant and deers of different types, the common animals of Central Indian forest, varieties of monkey species, bear, tiger and *citāh* deserve special mention.

Peacock, cuckoo and small crane type apart from wild birds were the ornithological types of the place. Interestingly the poet emphasized on the non-malicious animal behaviour pervading the entire surrounding. Obviously it was done for imparting a calm and serene environment, beneficial for mental balance of the forest dwellers.

Ethnic ecology: Forest being the abode of people with supernatural personifications, viz. *Kinnaras* and *Vidyādhara*s occupied a major part of population.

Environmental impact^{14a}: Rāma estimated the value of nature’s exquisite beauty as harmonious to three human dispositions, like, state of mind, state of way of thinking or feelings expressed through speech and state of body. (“*paśyanti vividhān bhāvān manovākkāya-sammatañ*”).

River Mandākini: It is generally known as a tributary of the Alakananda. Cunningham identifies it as Mandākini, a small tributary of the Paisundi in Bundelkhand which flows by the side of the Citrakuṭa. It is also known as Mālyavati¹⁵, and was the abode of lotus and other water-lilies and aquatic birds of varied types. Water was transparent and having swift flow. Round the bank was wood having blossoms throughout the year.

The riverine landscape in association with river, its holy and pleasing environments, reveals the ecological vistas comprising:

- a) The floral contents excepting lotus and water lilies in abundance, are not particularized.
- b) Aquatic birds of varied types, namely *Rathāṅga* (ruddy sheldrake), *Kāraṇḍava* (coot), *Krauñca* (pond heron), *Plava* (heron), *Haṁsa* (swan) and *Natyuha* (gallinule), along with the non-aquatic species, of melodious tune, like, cuckoo and *cakora* birds occupy the bird group. Frequency of non-malicious deer on bank for drinking of water, is notable as deer was a common animal in the central province forest types.
- c) River-bank population, a greater part of which occupied by ascetics, anchorites and *siddha-puruṣas* engaged in their daily spiritual rites and thus created a holy atmosphere.

The beautiful river with its elevated and non-elevated ground characters heightened by vivacious natural phenomena and spirituality may be categorised as religio-spiritualistic ecology pervading the entire riverine region.

Ecology of Citrakuṭa Forest:¹⁶ Apart from its two other components, it has some characteristics of its own. It reveals:

- a) Two-fold diversities in forest nature: wilderness and non-wilderness, the non-wilderness pervading the two associated eco-systems and transmission of the same to the forest environment. Intensity of wilderness is revealed in its unpenetrable condition to human beings and thus focusing horrifying aspects.^{16a} The wilderness possibly covered some stretch of the forest-land and not pervading the entire region.
- b) More woodland vegetation of which notable are *Kuṣṭha*, *Sthagaraka*, *Punnāga*, *Bhurja*, *Ingudi*. Among these *Kuṣṭha* and *Bhurja* are usually

Himalayan plant. Their occurrence in this forest seems unusual. Possibly Vālmīki had brought here the ecological traits of his native place.

- c) Faunal element adds a few more to those mentioned before. These generally consisted of more species of deer and wolf.
- d) Growth of a sub-forest within the area of Citrakuṭa forest, to the north-east of Citrakuṭa hill and river Mandākīnī is notable with its different water resources, fruits and root vegetables and fragrant flowery trees.
- e) Apart from tranquil and sweet, the erotic *rasa* or sentiment has got pre-eminence in the forest environment.¹⁷

Dandakāranya: Presently it includes parts of M.P., Orissa and Andhra Pradesh. This forested region owed its name to the demon Dandaka who lived there. Alternatively the name may indicate either (1) predominated by *Danda* plant. *Danda-trna* is a type of long grass and may be, the name originated from the abundance of this grass species, or (2) *Danda* means rows of trees, which might be another sylvan character.

The forest consists of wide forested plateau with numerous hills and sub-forests. Mandākīnī, Godāvarī and many streams flow by its sides.¹⁸

Diversities are noticed in land characters: Plain (*sama, sthalīprāya*) and elevated¹⁹ (*sthalamupara*). These are also noticed in green and non-green and in water elements – scarce (*durdars'a*) and abundance.²⁰

Though apparently green the forest's vegetation was divergent in nature excepting *Sāla* and *Madhūka*, the traditional plant character still noticed in Madhya Pradesh.

A number of sub-forests²¹ grew up either on single vegetation like, *Madhūkavana*, or rows of forest or wooded lands with diversities in floral and faunal characters and in water elements, like, lake, ponds having frequency of lotus and *Karanḍava* bird on the surface of water. Hill springs were other water element apart from principal rivers and their tributaries as common water sources.

Floral contents are identified only as flowery and fruit-yielding trees. The faunal elements consisted of deer herds, peacock and species of birds of mild temperament. No wilderness is traced. Hence a quiet environment within Dandaka forest which is characterized as of having utmost wilderness.²²

Rāma's early reaction to the Dāṇḍaka's wilderness in his very young age when he and Laksmana came to the forest with Viśvāmitra for killing Tādakā. The reactions or the landscape are expressed in this way:

"But soon they came to a trackless, dreadful-looking forest and Rāma asked the sage: "What a forbidding forest this is. Echoeing with swarms of crickets, it swarms with fearsome beasts of pray and harsh-voiced vultures. It is filled with all sorts of birds, screeching fearsome cries, as well as lions, tigers, bears and elephants. It is full of *Dhava*, *Aśvakarna*, *Kakubha*, *Bilva*, *Tinduka*, *Pāṭala* and *Badari* trees. What dreadfal forest is this?"²³ But forest lanscape underwent some changes when Rāma along with Sītā was moving through the forest:

"As they traveled with Sītā , they saw varied mountain landscapes, forests, lovely rivers with cranes and sheldrakes upon the sandbanks, ponds covered with lotuses and thronged with water-birds, dappled antelopes massed in herdes, rutting horned buffaloes and boars, and elephants butting at trees"²⁴

The two landscapes present two opposite environments:

I) In the first account, wilderness is focused everywhere as a) trackless, b) noisy, c) harsh cries of birds and animals, d) "echoeing with groups of crickets", e) two/three among the six trees are thormy (e.g. *Bilva*, *Badari*), one is, namely the *Tinduka* is however of somber dark green crown. All the elements of wilderness along with wild animals are brought in one scene only to heighten the gravity of describing it as abode of the Rāksasas.

II) The second environment possibly relate to a non-wild part of the forest usually selected for the set up of *āśrama* of the ascetics.

The environments might be natural diversities in forest ecology or might be poet's feeling over environmental psychology of the readers preferring landscape that are open, with a clear path and distant vista.²⁵

*Ethnicity:*²⁶ In compliance with forest diversities, Ethnicity shows diverse composition of forest locales. Pre-eminently a place for cannibalism of the Rākṣasa community, ascetics occupied a more of less big area of the forest. They are stated to have possessed superman powers to some extent "magical". The Araṇyakānda describes the supernatural powers of the great sage Sarabhaṅga and a group of 21 *munis*, each with peculiar activities. In addition,

mention may be made of the *kinnaras* (beings with human bodies and horse's heads) and *apsarās* (semi-divine female beings). Much studies have been made on the identity and historical basis for these forest inhabitants. They may be poet's imaginary figures to segregate forest wilderness, magical and enchanting elements.

Āśramas: The *āśramas* were big human habitations generally set up on the river banks or places having other watery sources. Here the forest nature is found in a modified form. The pleasing parts of the forest were selected for *āśrama*. In the *Rāmāyaṇa* (*Araṇyakāṇḍa*) the *āśramas* are described as “*aranyaiśca mahāvṛksaiḥ punyaiḥ svāduphalairvṛtam*”²⁷ which means “it abounds in sacred tall sylvan trees and in sweet fruit-bearing trees.”

The surrounding of *āśramas* used to be modified with desirable plants sylvan in character, but were medicinal, edible, ornamental and other utilitarians for spiritual performances with a view to humanizing forest ecology. Humanizing means changing the composition of trees to improve their usefulness. A picturesque scene of *āśrama* highlights its nature:

“Soon after entering the vast wilderness, the wilderness of Daṇḍaka, Rāma.... saw a circle of *āśramas* where ascetics dwelt. *Kus'a* grass and bark garments were strewn around it,..... It was a place of refuge for all creatures, its grounds were always kept perfectly clean and troops of *apsarās* ever paid homage there and danced. Spacious fire-sancturies, the sacrificial implements, the ladies, hide garments and *kus'a* grass, bundles of kindling pitchers of water, and roots and fruits made it beautiful too. It was encircled by tall forest trees and holy trees that bore fruits”.²⁸

Faunal contents are more or less same with the forest to which the *āśramas* belonged.

In addition to human population, the *āśramas* were the places for the *Siddhas*, *Gāndharva*, *Apsarās* and even Gods. Thus a completely separate cultural atmosphere pervaded there which in modern perception is known as *religious ecology*.

Pañcavati: This is a part of Daṇḍaka forest and earns pre-eminence as the place of Rāma's settlement in the said forest and Sītā was abducted by Rāvaṇa from this place. It was situated on the bank of Godāvarī and two leagues far

from the *āśramas* of Agastya. Having its growth on the calm and holy environment of the bank of Godāvarī with hill all around the woodland it seems to have come out in the midst of them.

A holy and beautiful ever-blossoming forested plain (*samam*)²⁹ shows an ecologically balanced stretch within the big forest. It was rich in floral contents comprising fruit-yielding, flowery, aromatic, hardwood and sacred holy basil with abundance of aquatic lotus.³⁰

Interestingly forest-grown food-grains like, barley, wheat and *sāli* rice, possibly cultivated by the native of the forest, also abound there. Vālmikī has nicely portrayed the ripening state of the grains in autumn. Even aquatic birds, like *Krauñca* (pond heron) and *Sārasa* (crane) in midst of forest grain-land in dancing mood are given due importance as a part of ecology of the place.³¹

The host of trees in the Pañcavati seem to have been transported and introduced by the indigenous people. The object of humanizing forest probably acted behind this.³²

Faunal characters were composed of ravenous animals and the speciality of Madhya Pradesh forest, viz. the deer herds and peacock. The aquatic birds were *Hamsa* (common swan), *Kārandava* (coot), and *Cakravāka* (ruddy sheldrake).³³

Ecological value of the modified forest: The six-fold importance of Pañcavati, enumerated several times by Rāma and the highly esteemed sages³⁴, comprise:

- 1) Proximity to watery place,
- 2) Abundance of useful plants: most of the plants reported here have medicinal values apart from other utilitarian values,
- 3) Teeming with birds for abundance of root-vegetables and fruits,
- 4) Aesthetic and sacred values of the place,
- 5) Availability of necessary forest products for performing daily worship,

The entire picture of Pañcavati is characterized as reclining in *sānta* or having a flavour of tranquility which is contrary to gravity of wilderness pervading the Daṇḍaka forest and further showing diversities in its ecology.

ALPINE REGION SEMI-FOREST SYSTEM, PARTICULARLY HIMALAYAN (*Oṣadhi-parvata*)

The alpine region semi-forest system, Himalayan in particular is not adequately described. What is important here, is the location of medicinal plant growing mountain in Himalayan region. The forest clad mountain of medicinal plants is stated to have been located between two mountains, Kailāsa and Rṣabha and stretched to a long area of over thousands of Yojanas.³⁵

Geographically Kailāsa belongs to trans-Himalayan Zone. Hanumāna's crossing of Himalayas to reach Kailāsa hints to the same.³⁶ This range, which is one of the three mountains of the trans-Himalayan zone contains a group of jointed peaks.³⁷ It is not improbable to think Rṣabha as one such jointed peak on the basis of established mythological relationship between Kailāsa and Rṣabha, presenting the former as the abode or Rudra-Śiva and the latter as the place of his carrier *Vṛṣa* (bull).³⁸ The *Oṣadhi* mountain named *Mahodaya* i.e. "great-rising" seems to be a separate rock arisen between the two.³⁸

*Description of Oṣadhi-mountain*³⁹: The long stretched woody outgrowth of host of medicinal plants on the central hill between Kailāsa and Rṣabha had on its southern peak the growth of four highly potential drug plants named after their particular curative properties. These were *Mṛtasañjīvani* or *Sañjīva-karaṇī*, i.e. revivification of dead with life-principle, *Viśalyakaraṇī* or *Viśalya*, i.e. removal of darts from body, *Suvarnakaraṇī* or *Savarnakaraṇī* giving glowing complexion or bringing back one in natural complexion wasted due to some seasons and *Sandhānakaraṇī* or *Sandhani* healing of fracture. Botanical characteristics of these medicinal plants are narrated as "glowing" and highly "aromatic". The strong aroma of the drug plants made the entire environment aromatic.

Ecological Phenomena: Excepting trans-Himalayan zone mountain-born forest of medicinal plants, nothing is available regarding surrounding natural objects, climate and the like, congenial for the growth of such a long stretched herbal concentration. Being the mid-most rock, its environment seems to have been influenced by spirituality of Kailāsa and wilderness of Rṣabha, being infested by animals.

In Vālmīki's narration prominence has been given on the peak, the birth-place of four highly potent medicinal plants. The rest of the forest is not highlighted. Bio-diversity, water element, etc., are left untold. The only bio-phenomenon, besides wood in general, is the reference to elephant which is a common animal in Himalayan forest. The metal depositions on the particular mountain peak may be noted in this matter.⁴⁰

EVERGREEN FOREST OF LAṄKĀ

There is no major difference between tropical deciduous forest and evergreen Laṅkān forest stated as green wood. Natural forest and Naturalised forest are the two fold sylvan characters of Laṅkān forest.

The *Natural Forests* are mainly sub-forests. The other forest-features, like rock-plants, sufficient water-sources and their bio-diversity are the ancillaries to the ecology of these natural forests. The forest plants have also been given due importance in the narration of Laṅkān dense-green wood.⁴¹ Plants here comprise *Sarala*, *Karṇikāra*, *Kharjura*, *Priyāla*, *Muculinda*, *Kuṭaja*, *Ketaki*, *Priyaṅgu*, *Nipa*, *Saptacchada*, *Asanā*, *Kovidāra*, *Karavīra*.⁴² Faunal element consist of only common aquatic birds. Interestingly no wild animals are reported.

The *Naturalized forest* is best presented in the graphic account of *Asōka-vana*, named after the principal plant, *Asōka*. As a sister evergreen forest, though naturalized, it shows all the elements of forest eco-system. In the lay out of this naturalized forest large open spaces at places (*bhūmibhāga*) deserves mention. The ecological balance is fully maintained in the presence of sufficient water sources inclusive of ponds, mountain-springs, and even river naturalized significantly as a mountain-born river. Mountains, the other forest phenomenon, bear the impression of Kailāsa and Gandhamādana as if acclimatized there.

Bio-diversity excels in the propagation and acclimatization of various plants, comprising:

- i) Varieties of *Asōka* of different colours viz. golden, fiery red, dark coloured, *Bakula*, *Bhavya* (neem).

- ii) *Campaka, Candana, Nāgakes'ara, Sāla, Uddālaka* mentioned apart from all types of seasonal fruits and flowers; mango-groves.⁴³
- iii) *Kalpa-vṛkṣa (Santānaka)* excellent in a fragrance and continuous cozing of juice from them is described as entwined with hundreds of creeping vegetation and covered with flowers.
- iv) Lily forest covering the entire water surface.
- v) Faunal character composed of aquatic birds like, swan, duck, crane, *cakra* birds and *natyuhā*; birds of sweet notes, like cuckoo; peacock; deer herds.

The evergreen *Asóka-vana* might be taken as garden where nature is presented as resplendent garden. This type of nature gardens are found to have been grown by the forest departments in different parts of India today (Karnataka, north Kanara, etc.). In these forest gardens generally the vegetable compositions are both native and exotic.⁴⁴

In conclusion, it is of interest to mention that the forest ecology of deciduous tropical types found in the entire narrative is not uniform throughout, specially its natural and super-natural features and even *rasas* predominating there are not properly reflected. Reason perhaps is due to the difference in physical characters of forests. The alpine forest is however of completely different trait and is beyond estimation. Larikān evergreen forest, a major part of which specially the *Asóka-vana*, on the other hand, is a naturalized forest and lacks diversity, though sylvan characters are maintained there. However the epic trait of narrative eco-system is detailed everywhere and is very prominent.⁴⁵

Appendix I

Plants in different deciduous tropical forests and in evergreen Lankan forests:

| Names and English Equivalent | Scientific Name | Forest |
|---|---|--|
| Āmalakī (Myrobalan) | <i>Emblie myrobalan</i> | Citrakūṭa (inclusive of the two associated ecosystem hill and river Mandākini) |
| Āmra; Cūta (Mango) | <i>Mangifera indica</i> | All the three forests (inclusive of Pañcavati) |
| Ariṣṭa (Soap-berry) | <i>Sapindus mukorossi</i> | Citrakūṭa |
| Asanā; Bižaka | <i>Tomentosa bedd.</i> | Citrakūṭa; Evergreen Lañkān forests |
| As'oka | <i>Saraca indica</i> | Citrakūṭa; Evergreen Lañkān forests |
| As'vakarnā (Bengali-Sajja, Sāl, Garjan) | A variety of <i>Shorea robusta</i> or <i>Dipterocarpus alatus</i> | Pañcavati |
| Badara, Badari | <i>Zizyphus jujuba</i> | Citrakūṭa; Dañḍakāranya |
| Bakula | <i>Mimusops elengi</i> | Evergeen Lañkān forests |
| Bhallaṭaka | <i>Semecarpus anacardium</i> | Citrakūṭa (marking nut tree) |
| Bhavya* | <i>Averrhoa carambola</i> , Linn | Citrakūṭa |
| (i) Kāmaraṅgā; | <i>Azadirachta indica</i> | Evergreen Lañkān forest |
| (ii) neem, margosa leave | | |
| Bhurjapatra** (Indian birch tree) | <i>Betula bhojapatra</i> | Citrakūṭa |
| Bilva | <i>Aegle marmelos</i> | Citrakūṭa; Dañḍakāranya |
| Campaka | <i>Michelia campa</i> | Pañcavati; Evergreen Lañkān forest |

* Possibly region-wise variation, ** *Bhurjapatra* in central India seems very unusual. It is a commonly growing tree in Himalayan region

Appendix I (Conti.)

| Names and English Equivalent | Scientific Name | Forest |
|--|--|-------------------------------------|
| <i>Candana</i> (Sandal wood) | <i>Santalum album</i> , Linn | Pañcavaṭī; Evergreen Lan kān forest |
| <i>Dhava</i> | <i>Anogeissus latifolia</i> | Danḍakāranya |
| <i>Dharvana</i> (Indian linden tree) | <i>Grewia tilialfolia</i> , Vahl. | Citrakūṭa |
| <i>Ingudi</i> (Zachum Oil Plant) | <i>Balanites roxburghii</i> , Planchor | Citrakūṭa |
| <i>Kakubha</i> (Arjuna tree) | <i>Terminalia arjuna</i> , Linn. | Danḍakāranya |
| <i>Kamala</i> (Red lotus) | <i>Nelumbo speciosum</i> | Citrakūṭa |
| <i>Karṇikāra</i> | <i>Cassia fistula</i> | Evergreen Lan kān forest |
| <i>Karavīra</i> | <i>Nerium indicum</i> , Mill | Evergreen Lan kān forest |
| <i>Kāśmari</i> | <i>Gmelina arborea</i> | Citrakūṭa |
| <i>Ketaki</i> | <i>Pandanus odoratissimus</i> | Pañcavaṭī |
| <i>Khadira</i> | <i>Acacia catechu</i> | Pañcavaṭī |
| <i>Kharjura</i> (Date palm) | <i>Phoenix sylvestris</i> | Pañcavaṭī; Evergreen Lan kān forest |
| <i>Kimśuka</i> | <i>Butea frondosa</i> | Citrakūṭa; Evergreen Lan kān forest |
| <i>Kovidāra</i> | <i>Bauhinia variegata</i> Linn. | Evergreen Lan kān forest |
| <i>Kuṣṭha</i> (<i>utpala</i> = <i>Sthalapadma</i> *) | <i>Hibiscus mutabilis</i> | Citrakūṭa |
| <i>Lodhra</i> | <i>Symplocos racemosus</i> | Citrakūṭa |
| <i>Madhūka</i> | <i>Bassica latifolia</i> | Citrakūṭa; Danḍakāranya |
| <i>Muculinda</i> (<i>Jambīra</i> <i>nimbu</i> , ---Commentary) | <i>Citrus acida</i> (a variety) | Evergreen Lan kān forest |

* *Kuṣṭha* here is *utpala*, *sthalapadma* implying *kuṣṭha* is non-aquatic, according to commentator.

Appendix I (Conti.)

| Names and English Equivalent | Scientific Name | Forest |
|---|---|---|
| <i>Nāgakes̄ara</i> | <i>Mesua ferrea</i> | Evergreen Lañkān forest |
| <i>Nīpa</i> | <i>Nuclea cadamba</i> (big variety) | Citrakūṭa; Pañcavaṭī; Evergreen Lañkān forest |
| <i>Nīvara</i> (= <i>Jalakadamba</i> , <i>Anthocephalus</i> possibly implies her <i>Dhārākadamba</i>) | <i>Cadamba</i> | Pañcavaṭī |
| <i>Padma</i> (white water lily) | <i>Nymphaea alba</i> , Linn | Evergreen Lañkān forest |
| <i>Panasa</i> (jack-fruit tree) | <i>Artocarpus integrifolia</i> , Linn | Pañcavaṭī |
| <i>Parnāsa</i> (Holy basil) | <i>Ocimum villosum</i> | Pañcavaṭī |
| <i>Paṭala</i> | <i>Stereospermum suaveolens</i> | Dañḍakāraṇya; Pañcavaṭī |
| <i>Priyangu</i> | <i>Aglaia roxburghiana</i> | Evergreen Lañkān forest |
| <i>Puṣkara</i> (white lotus) | <i>Nelumbium speciosum</i> (a variety) | Citrakūṭa |
| <i>Sāla</i> | <i>Shorea robusta</i> | Dañḍakāraṇya; Pañcavaṭī; Evergreen Lañkān forest |
| <i>Santanaka</i> (= <i>Kalpavṛkṣa</i> with botanical characters) | Not identified | Evergreen Lañkān forest |
| <i>Sarala</i> | <i>Pinus longifolia</i> | Evergreen Lañkān forest |
| <i>Sthagara</i> (= <i>Putrajīvaka</i>) | <i>Putranjiva roxburghii</i> | Citrakūṭa |
| <i>Syandana</i> | <i>Dalbergia ougensis</i> | Pañcavaṭī |

Appendix I (Conti.)

| Names and English Equivalent | Scientific Name | Forest |
|--------------------------------------|-----------------------------|--------------------------|
| <i>Tamāla</i> (Āblus Kāṭh) | <i>Diospyros tomentosa</i> | Pañicavati |
| <i>Tilaka</i> (Red-wood tree) | <i>Adenathera pavonina</i> | Pañicavati |
| <i>Tinduka</i> (Ebony) | <i>Diospysros glutinosa</i> | Danḍakāranya |
| <i>Uddā laka</i> (Indian chowlee) | <i>Vigna catjang</i> | Evergreen Lanikān forest |
| <i>Vamśa</i> | <i>Bambusa arundinacea</i> | Pañicavati |
| <i>Varaṇa</i> (Sacred caper tree) | <i>Craetova religiosa</i> | Citrakūṭa |
| <i>Vetasa</i> or <i>Vetra</i> (Cane) | <i>Calamus rotang</i> | Citrakūṭa |

Appendix II

Animals and Birds in different tropical forests and ever-green Lanikān forests:

| Name & English equivalent | Scientific Name | Forest |
|---|---------------------------|---|
| <i>Bhringarāja</i> (fork-tailed shrike) | <i>Dicurus indicus</i> | Danḍakāranya |
| <i>Cakravāka</i> , syn: <i>Rathāṅga</i> ; <i>Rathāhvā</i> (Ruddy shelduck) | <i>Todorna ferruginea</i> | Citrakūṭa; Danḍakāranya; Pañicavati; Evergreen Lanikān forest |
| <i>Dvīpi</i> (Panther) | <i>Felis pardus</i> | Citrakūṭa |
| <i>Gaja</i> , syn. <i>Nāga</i> ; <i>Vāraṇa</i> (Elephant) | <i>Elephas indicus</i> | Citrakūṭa; Danḍakāranya |
| <i>Gavaya</i> (Goyal ox) | <i>Bos frontalis</i> | Citrakūṭa |
| <i>Gokarṇa</i> (cow eared deer) | <i>Antelope picta</i> | Citrakūṭa |

Appendix II (Conti.)

| Name & English equivalent | Scientific Name | Forest |
|---|---|---|
| <i>Golāṅgula</i> (cow tailed monkey) | | Citrakūṭa |
| <i>Haṁsa</i> (swan) | <i>Cygnus olor</i> | Pañcavaṭī |
| <i>Jhilikā</i> (cricket) | a leaping orthopteran insect family: family: <i>Grillidae</i> | Daṇḍakāraṇya; |
| <i>Kāraṇḍava</i> (coot) | <i>Fulica altra</i> | Citrakūṭa; Pañcavaṭī |
| <i>Kokilā</i> (Indian koel) | <i>Endynamis honorata</i> | Citrakūṭa; Evergreen Laṅkā forest |
| <i>Koyaṣṭhi</i> (green-bill coucal) | <i>Centrophorus chlorhynchus</i> | Citrakūṭa |
| <i>Krauñ ca</i> (pond heron) | <i>Ardea grayii</i> | Citrakūṭa; Pañcavaṭī |
| <i>Mahiṣ a</i> (buffalo) | <i>Bos Bubalus</i> | Citrakūṭa; Daṇḍakāraṇya |
| <i>Mayūra</i> (syn: <i>varhi</i> peacock) | <i>Pavo cristatus</i> | Citrakūṭa; Pañcavaṭī, Evergreen Laṅkā forest |
| <i>Mṛga</i> (roe deer) | <i>Capreolus capreolus</i> | Pañcavaṭī, Evergreen Laṅkā forest |
| <i>Natyula</i> (Gallinule) | <i>Rallidae</i> | Citrakūṭa |
| <i>Plava</i> (possibly grey heron) | <i>Ardea cinera</i> | Citrakūṭa |
| <i>Pr̥ṣata</i> (spotted dear) | <i>Cervus axis</i> | Citrakūṭa; Daṇḍakāraṇya |
| <i>Rkṣa</i> (bear) | <i>Melursus ursinus</i> | Citrakūṭa |
| <i>Sārasa</i> (Indian crane) | <i>Megalornis grus</i> | Citrakūṭa; Daṇḍakāraṇya Pañcavaṭī |
| <i>Siṁha</i> (lion) | <i>Felis leo</i> | Citrakūṭa |
| <i>Sṛ mara</i> (Indian wild boar) | <i>Sus cristatus</i> | Citrakūṭa |
| <i>Tarakṣu</i> (hyena) | <i>Hyena striata</i> | Citrakūṭa |
| <i>Vānara</i> (Indian monkey) | <i>Semnopithecus entelus</i> | Citrakūṭa |
| <i>Varāha</i> (pig) | <i>Sus scrofa</i> | Citrakūṭa |
| <i>Vṛka</i> (wolf) | <i>Canis lupus</i> | Daṇḍakāraṇya |
| <i>Vyāghra</i> (tiger) | <i>Felis tigris</i> | Daṇḍakāraṇya |

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