

Untangling Multiple Topographical Systems: Conceptions of Landscapes in Ancient Indian Medicine¹

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Abstract

Landscapes might be a minor topic in the field of classical Āyurveda; however, they actually do play an important role in several contexts. For example, the constitution of the patients depends on their natural surroundings, the quality of food and medicinal plants is defined by the habitat of plants and animals, and the wholesomeness of drinking water is determined by the clime at its source. Thus, we find references to all kinds of landscapes in the compendia of ancient Indian medicine. However, not only terrestrial space is mapped. Water and sky as well are regarded as living environments of animals which in turn serve as food for humans and have specific characteristics according to their roaming area.

This study is based on a search for references to landscapes in all possible contexts of the four eminent source texts of ancient Indian medicine, the Carakasamhitā, the Suśrutasamhitā, the Aṣṭāṅgasamgraha and the Aṣṭāṅgahṛdayasamhitā. Its first part presents the gathered information systematically rearranged and discusses the differences and similarities between plant and animal habitat, as well as the human environment. The second half is dedicated to the specific types of landscapes, describing them based on the findings in the source texts and showing their various impact on water, plants, animals, people and medicinal practice in general.

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1. Introduction

The categorization of landscapes is relevant for Indian medicine in more than one way; it is therefore discussed in various sections of the ancient medical compendia.² The crucial Sanskrit term here is *deśa*, usually translated as “region” or “country”.³ However, in this context the so-called *deśa*-s are well-defined landscapes or climatic zones with specific characteristics. These landscapes primarily represent the living environments of patients. Depending on their characteristics, they are responsible for different personal constitutions and specific dispositions with regard to diseases. Hence they demand diverse modes of life, diets and treatments for the people occupying them.⁴ Besides, they are also the habitat of plants and animals that serve as food for these patients and play a role in defining the properties of foodstuffs and of remedies of plant and animal origin.⁵ Finally, they constitute the spheres in which various bodies of water exist which are also influenced by them.⁶

Francis Zimmermann discussed these issues in his 1987⁷ monograph *The Jungle and the Aroma of Meats. An Ecological Theme in Hindu Medicine*, focusing on the understanding of connections between ecological conditions and bodily processes based on the *Suśrutasamhitā*, the *Carakasamhitā* and the

²This study considers the two oldest foundational medical compendia, the *Carakasamhitā* and the *Suśrutasamhitā*, both dating to the period between 250 BC and 150 AD, as well as both works ascribed to Vāgbhata, the *Aṣṭāṅgasamgraha* and the *Aṣṭāṅgahrdayasamhitā*, which came into existence around 700 AD and heavily depend on the two older works. Where advisable, the commentaries on these texts were also consulted.

³In his *Geographical Dictionary*, N.N. Bhattacharyya describes *deśa* as a “territorial term meaning a small area or a group of villages in some cases but a kingdom, district, tract or country in others. [...]” (Bhattacharyya, 1991, p. 33.) In the source texts of ancient Indian medicine, *deśa* denotes territories characterized by a specific, homogeneous natural appearance. We find no information about their size, but as the classifications only refer to a few different types of *deśa*-s we have to assume that also vast areas with more or less uniform characteristics were designated by the same term. See also “5. The Types of Environments” on p. 49 in this article.

⁴See CaS 1.26.88 and 3.3.47–48 and AS 1.18.28–29.

⁵Concerning the animal habitat, see CaS 1.27.332. For the plant habitat, see CaS 7.1.8–9, AS 5.8.2 and AHS 5.6.1–2.

⁶See CaS 1.27.214, SuS 1.45.37cd–39ab, AS 1.6.15 and AHS 1.5.13ab. See also Angermeier, 2017, pp. 77–93.

⁷This book is a translation of his 1982 monograph *La jungle et le fumet des viandes* with some improvements in the references (see Zimmermann 1987, p. xi).

Aṣṭāṅgaḥṛdayasaṃhitā. He describes how, besides the seasonal climate, specific landscapes or climate zones determine the circumstances in which humans have to combat diseases and protect health. Apart from this book, no relevant studies were undertaken to analyze the significance of landscapes for Indian medicine in detail.⁸

In this article I firstly want to untangle the multiple applications of topographical classifications and discuss their differences. Secondly I will concentrate on the specific landscapes mentioned in the source texts and give analytical summaries of their depictions in the medical Saṃhitās. Finally, based on my analyses I will review Zimmermann's observations and try to clarify certain ambiguities.

2. Dry and humid, warm and cold

The double dualistic principle of dry and humid as well as warm and cold, which generally plays a great role in Indian medicine,⁹ is decisive for distinguishing the various human living environments, animal and plant habitats as well as hydrological spheres. It is used to structure them and to ascribe specific and relevant medical properties to them. On this issue, Zimmermann notes:

“The polarity between fire and water, dryness and unctuousity, is literally inscribed on the map of India, as is clearly spelled out in the Ayurvedic catalog of running waters, the list of *jāṅgala* plants, and the zones over which *jaṅghāla* and *kūlacara* animals are respectively distributed.”¹⁰

The two extremes are represented by the terms *jāṅgala*¹¹ and *anūpa*. The first

⁸There are some articles that build on Zimmermann's book, e.g. Dove, 1992. In this study, Dove concentrates on the historical transformation of the meaning of *jāṅgala*.

⁹The dichotomy of temperature and humidity governs the seasonal climate and defines the properties of bodily, alimantal and medicinal substances. It is therefore quite relevant in dietary and medical prescriptions and therapies. On the seasons see Angermeier, 2017, pp. 24–29, on (liquid) bodily substances *ibid.*, pp. 109–137, and in general Zimmermann, 1987, pp. 218–223.

¹⁰Zimmermann, 1987, p. 67.

¹¹Synonyms are *dhanvan* and *maru*. In order to make this terminological variety visible, I will use as translation “dry/dryland” for *jāṅgala*, “savanna” for *dhanvan* and “steppe” for *maru*. The frequently adopted translation equivalent “desert” for *dhanvan* and *maru* does not fit here because we are talking about fertile land that is suitable for pastures and

denotes the arid savanna, the latter the humid tropical areas which spread mainly along bodies of water. This is nicely summarized in CaS 3.3.47–48:

*alpodakadrumo yas tu pravātaḥ pracurātapah,
jñeyah sa jāṅgalo deśaḥ svalparogatamo 'pi ca. (47)
pracurodakavr̥kṣo yo nivāto durlabhātapah,
anūpo bahudośaś ca, samaḥ sādharmaṇo mataḥ. (48)*

A landscape, however,

- with sparse water and trees,
- which is exposed to stormy winds,
- with abundant heat from the sun

is to be recognized as dry (*jāṅgala*) and also as one where very few diseases exist. A landscape

- with abundant water and trees,
- sheltered from the wind,
- where heat from the sun is obtained only with difficulty

is to be recognized as marshy (*anūpa*) and as containing much harm.¹² An intermediary landscape is considered balanced.¹³

agriculture. See Zimmermann, 1987, pp. 12–19 and Dove, 1992, pp. 234–237.

¹²Or: “... containing many morbidic factors”. These morbidic factors would be the three so-called *doṣa*-s bile, wind and phlegm.

¹³In most editions of the CaS, these two verses are inserted at the end of a lesson that is dedicated to the topic of mass mortality where they appear somehow out of place. In the edition of Jāḍavji, which I use as my standard source, they are bracketed. Wujastyk explains: “This section was not present in most of the manuscripts available in the 11th century to the commentator Cakrapāṇidatta” (Wujastyk, 1998, p. 91). He supposedly concludes this from Cakrapāṇidatta’s commentary, which tells us that only some scribes/scholars read this description of the landscapes here (*kecid alpodakadrumo yas tv ityādigrantham jāṅgalādideśalakṣaṇam atra paṭhanti*). On the exact situation in the editions, see Angermeier, 2007, pp. 32–33. Of the manuscripts that were considered in the FWF project “Philosophy and Medicine in Early Classical India III” (on this project, see www.istb.univie.ac.at/caraka/) the majority contains them while 9 omit them. According to the preliminary stemma established in the project, the omitting manuscripts (A, Ap1, C3, C4, Ca, Jn4, L2, V1 and V2) do not represent a very coherent group (see www.istb.univie.ac.at/caraka/Materials/31).

Francis Zimmermann's *The Jungle and the Aroma of Meats* includes an elaborate discussion of the two terms *jāṅgala* and *ānūpa*.¹⁴ The first is the very word from which the English “jungle” has developed.¹⁵ According to Sanskrit dictionaries, *jāṅgala* (as an adjective) means “dry”, “sparsely vegetated”, but also “fertile”, “rural”, “wild”, “uncivilized” and “uncultivated”. Zimmermann explains that there is no uniform translation for this term: while in classical Sanskrit it denotes dry land and uninhabited, uncultivated land, in classical Hindi¹⁶ its meaning changes to denote wild or non-civilized land, forest, tall grasses and a picturesque landscape. In English, this comes to denote luxuriance and insalubrious, malarial land,¹⁷ which is exactly the denotation of the Sanskrit term *ānūpa*, a landscape that spreads “along the water” and is considered an unhealthy living environment.

3. Animal and Plant Habitat

If, besides humans, also animals are to be classified according to their environments, notions of terrestrial environments like dryland and wetland are insufficient. Therefore, in some contexts we find a somewhat similar but nevertheless new terminology. In Ayurveda, animals are primarily relevant as a dietetic factor. Thus not the animals themselves, but their meat is discussed. A lesson¹⁸ in the CaS which enumerates dietetically and medicinally relevant substances (including the meats of animals) in conclusion lists some factors to be considered while utilizing these substances. The first of these factors¹⁹ is denoted by

¹⁴Zimmermann, 1987; the two mentioned verses are discussed there on pp. 38–41.

¹⁵On this development see also Dove, 1992.

¹⁶Zimmermann uses this term in reference to the dictionary he consulted, namely J. T. Platts, *A Dictionary of Urdu, Classical Hindi and English*. Oxford 1930. The first edition of this dictionary dates from 1884 and was published in London by W. H. Allen & Co.

¹⁷See Zimmermann, 1987, pp. 10–16.

¹⁸On the meaning of *adhyāya* in the Carakasamhitā and other works, cf. Preisendanz, forthc. 2017.

¹⁹The other factors according to CaS 1.27.331 are body part (*śarīrāvayava*), natural constitution (*svabhāva*), bodily constituent (*dhātu*), activity/behavior (*kriyā*), sex (*liṅga*), size (*pramāṇa*), preparation (*saṃskāra*) and quantity (*mātra*). Though most of these terms seem to be related to animals or their products, in general they also apply to plant and mineral substances. It seems that only the suitable factors are to be considered in the case of a specific substance. Terms like *śarīrāvayava* may have a wider meaning and also apply to parts of plants and so on.

the term *cara*²⁰, explained here in CaS 1.27.332–333 as follows:

caro 'nūpajalākāśadhanvādyo bhakṣyasamvidhiḥ,
jalajānūpajāś caiva jalānūpacarāś ca ye. (332)
gurubhakṣyāś ca ye sattvāḥ sarve te guravaḥ smṛtāḥ,
laghubhakṣyāś tu laghavo dhanvajā dhanvacāriṇaḥ. (333)

cara is the milieu²¹ of food, such as wetlands, water, sky or steppe. All beings

- that are born in water or wetlands as well as those
 - which roam the water or wetlands and those
 - whose food is heavy
- are deemed heavy. Those, however,
- whose food is light,
 - which are born in the savanna and
 - which roam the savanna
- are light.

Here we have more than the two well-known types of landscape: water and sky are recognized as further living environments. What remains the same is the dualistic principle of humid and dry which splits the types of environment in two classes. The dietetic value of substances is reduced to the qualities of light and heavy, i.e. easy or difficult to digest. We can find this reduction already in CaS 1.27.46cd–60, where groups of animals are divided into two categories with the mention of some further qualities: animals of the first category²² have heavy, warm, oily and sweet meat which promotes strength and growth. Those

²⁰For *cara* see also Zimmermann, 1987, pp. 21–22. In specific contexts it is justified to translate *cara* as “ecosystem”. Like *cara*, “ecosystem” has a two-dimensional meaning, inasmuch as it includes the living environment as well as the living beings occupying it, thus describing their functional interdependency. However, the difference is that *cara* relates not only to ecology, but also to dietetics.

²¹According to the dictionaries, the meaning of *saṃvidhi* or *saṃvidhā* is “disposition”, “arrangement” or “preparation”. The translation “milieu” is not to be understood in a strict sociological sense, but as comprising the mentioned meanings in a less than strict manner. Thus, *cara* denotes the way in which the food of humans – either of animal or plant origin – is disposed or arranged in its natural surroundings.

²²This comprises animals that snatch their food (*prasaha*), animals living in burrows (*bhūśaya*), animals living in the wetlands (*ānūpa*), water animals (*vārija*) and water birds (*vāricārin*).

of the second²³ have light, cold, sweet and slightly astringent meat. Animal meat of the “heavy” category agitates the wind in the human body and reduces phlegm and bile, while meat of the “light” class is beneficial when all three morbid factors of the patient, especially bile, are agitated (see Table 1).

Table 1: Effects of the environment on the meat of animals living there

clime	digestibility	temperature	character	taste	dietetic effect
humid	heavy	warm	oily	sweet	– phlegm, bile + wind
dry	light	cold		sweet, astringent	– wind, phlegm, esp. bile

The taxonomy of the three aforementioned landscapes is sufficient when plants are categorized according to their surroundings.²⁴ The beginning of the first lesson of the Kalpasthāna in the Carakasamhitā (CaS 7.1), which is dedicated to the application of *madanaphala*,²⁵ contains general rules for the collection and storage of plants. The three types of habitat – here the term is again *deśa* – are described as follows:

- dry (*jāṅgala*) landscapes are dominated by wind and the heat of the sun and have forests and sandy or pebbly soils;
- wet (*anūpa*) landscapes receive little sunlight, are sheltered from wind but nevertheless affected by frosty winds, richly wooded, mostly situated along rivers or the ocean, and provided with overgrown mountains;
- intermediary (*sādhāraṇa*) landscapes represent a temperate mix of the previous two types.²⁶

²³This category comprises quails and similar birds (a subgroup of the birds which scatter called *viṣkira*-s), pecking birds (*pratuda*) and wild animals from the drylands (*jāṅgalamṛga*).

²⁴While water plants are sometimes referred to as medicinal plants, in the examined sources they are not mentioned under the above categories of plant habitats.

²⁵The fruit of *Catunaregam spinosa* (Thunb.) Tirveng., which is mostly used as an emetic, is sometimes identified as the emetic nut, but not to be confused with the so-called poison nut (*Strychnos nux-vomica* L.) or the clearing nut (*Strychnos potatorum* L. f.). On *madanaphala*, see Vogtherr, 1894, and for the two types of *Strychnos* Angermeier, 2016, p. 209.

On the handling of Sanskrit plant names in this paper, see the Appendix.

²⁶See CaS 7.1.8. The commentator Cakrapāṇidatta, who tells us that some scribes/scholars

When animal products are discussed, substances belonging to all kinds of living environments are included and recommended depending on the circumstances. Here, only plant material from dry or balanced landscapes – the environments considered as wholesome – are recommended for medicinal usage.²⁷ Plant material from the wetlands should apparently be avoided altogether. This notion can also be found in AS 5.8.2 and AHS 5.6.1–2 in similar contexts.

4. The Human Environment

Humid landscapes, abounding in water, are generally estimated as unhealthy. We can see this by examining the descriptions of different environmental influences on humans. Already in the initially cited passage CaS 3.3.47–48 it is stated that there are few diseases in dry areas while much harm or many morbid factors (*doṣa*) characterize the wetlands.

Generally, the doctrine of *doṣa*-s is employed to analyze the impact of the surroundings on humans and human food. In the aforementioned lesson CaS 7.1, the *doṣa*-s, which normally are only encountered as bodily constituents, are directly ascribed to the landscapes: the drylands are rich in wind and bile while in the wetlands wind and especially phlegm abound (see CaS 7.1.8). This attribution again follows the double dualistic principle of dry/humid and warm/cold. Although bile is in fact considered liquid, as the single warm factor among the *doṣa*-s it has to be connected with the hot drylands. Similarly, wind – even though it is considered cold – is associated with this type of landscape because it is the only dry factor among the three. In the case of the (cool) wetlands, cold phlegm replaces warm bile which does not fit here systematically. The balanced landscapes are described as being endowed with a balanced constellation of morbid factors. Thus, even though one might conceive of a nice analogy

do not read the aforementioned verses CaS 3.3.47–48, here explains that exactly these persons do not accept 7.1.8 as authentic. Nevertheless, this prose segment fits much better into its context than the two verses in CaS 3.3. The previous paragraph (7.1.7) lists landscape (*deśa*), time (*kāla*), quality (*guṇa*) and receptacle (*bhājana*) as factors to be considered with the aim to control the effectiveness of remedies. These factors are explained one after the other in 7.1.8–10 and *deśa* is described as differentiated threefold, namely dry, humid and balanced. The whole Kalpasthāna (i.e. CaS 7) is probably younger than the Vimānasthāna (CaS 3) because, according to the tradition, it was rewritten by the redactor Dṛḍhabala. However, we cannot know for certain whether the probably interpolated verses in CaS 3.3 existed there already before his activity as a redactor.

²⁷ See CaS 7.1.9.

between the three morbidic factors and the three landscapes, the dualistic principle proves stronger. This sophisticated system is somehow in contradiction to the observations made in CaS 3.3.47–48, according to which the wetlands are generally abundant in morbidic factors (*bahudoṣa*) and the drylands very poor in diseases (*svalparogatama*). Perhaps this can be explained by the fact that the word *doṣa* is not always used as a technical term and can also, more generally, denote a harmful factor. On the other hand, the contradiction may be due to the fact that 3.3.47–48 are an interpolation.²⁸

This terminologically vague usage of the word *doṣa* and its recurring substitution by other terms suggests that the doctrine of the morbidic factors was not systematically integrated into the notion of the environments. Also in SuS 1.45.37cd–39ab it is not readily apparent whether the word *doṣa* is to be understood strictly in a terminological sense or whether it denotes unspecific deficits or harmful factors. In AS 1.1.44–45, however, it is obvious that the word *mala* is used instead of *doṣa* in its terminological sense. We thus have two groups of passages: one clearly ascribes certain morbidic factors to specific environments, and the other merely talks about deficits / harmful factors or mentions morbidic factors in general without naming them (cf. table 2).

Table 2: Prevalence of morbidic/harmful factors according to landscapes

passage and context	humid	intermediary	dry
CaS 3.3.47–48 (landscapes)	many morbidic factors / much harm	balanced	–
CaS 7.1.8 (landscapes/humans)	wind, phlegm	balanced	wind, bile
SuS 1.35.42 (sources of disease)	wind, phlegm	balanced	wind, bile
SuS 1.45.37cd–39ab (water)	many morbidic factors / much harm	–	no morbidic factors / harm
AS 1.1.44–45ab (landscape)	phlegm	balanced	wind
AS 1.18.28–29 (landscape)	phlegm, bile ²⁹	–	–

²⁸ See footnote 13.

²⁹ On this configuration see footnote 42.

Next to the doctrine of the three morbidic factors, the concept of the six tastes is significant in dietetics in Indian medicine. It is therefore reasonable to examine the interrelation between tastes and landscapes. In fact, a passage in the *Aṣṭāṅgasamgraha* (1.18.28–29) connects the two. After the repeated characterization of humid and dry landscapes, this passage introduces two new categories by proposing a moderately humid and a moderately dry environment instead of a single intermediary landscape. These four landscapes are then described as sources of the tastes: wetlands are the source of sweet taste, drylands bring forth pungent taste, moderately humid areas are known for salty as well as sour taste and moderately dry regions are the origin of bitter and astringent taste (cf. table 3).

Table 3: Landscapes and tastes according to AS 1.18.28–29

landscape	taste
moderately humid	sour salty
humid	sweet
moderately dry	bitter astringent
dry	pungent

This doctrine here in the *Aṣṭāṅgasamgraha* is a special case and found neither in the closely related *Aṣṭāṅgahrdayasamhitā* nor in CaS or SuS. When types of meat are discussed, it is more customary to describe animal products from wetlands as sweet and those from drylands as sweet–astringent.³⁰ Even the author of the AS sticks to this concept in a lesson dedicated to the characteristics of food products when he describes *jāṅgala* meat as astringent and sweet.³¹ However, it can be observed that this fixed attribution is much more evident in the earlier works (CaS and SuS) than in the later compendia by Vāgbhaṭa (AS and AHS), in which the different meats are described with less consideration of the tastes and not as systematic, but in more detail.

³⁰See CaS 1.27.56cd–61ab (overview on the qualities of meat types), SuS 1.45.131 (qualities of animal fats), SuS 1.46.54–92 (animals from the drylands), SuS 1.46.93–125 (animals from the wetlands) and AS 1.7.84cd–106 (qualities of meat types).

³¹See AS 1.7.84cd–85.

In spite of its singularity, this doctrine of four types of landscape and six tastes fits quite nicely into the corpus of classical Ayurveda. For instance, it correlates with the connection between tastes and seasons, where bitter, astringent and pungent taste are connected to the dry period of the year, while sour, salty and sweet taste are qualities of its humid phase.³²

5. The Types of Environments

To this day, Sri Lanka, the Malabar Coast – from the most southern point of Kerala up to Mumbai – and the East – mainly Bengal and Orissa – are the regions of South Asia with the largest amount of monsoon rain. These are the tropical-humid regions of the subcontinent which never dry out completely and are the habitat of those animals referred to as *ānūpa* in the dietetic lists of the medical works. In *The Jungle and the Aroma of Meats*, Zimmermann repeatedly demonstrates that *jāṅgala* and *ānūpa* do not merely denote small regional landscapes but divide the whole of South Asia into a few large climatic zones.³³ These zones serve congruently as the habitat of specific plants and animals and as defined separate living environments for humans.

Wetlands (*ānūpa*)

The most comprehensive description of wetlands is found in CaS 7.1.8, in a lesson which is dedicated to the collection of medicinal plants. *ānūpa* is described here as follows:

[...] *athānūpo hintālatamālanārikelakadalīvanagahanah, saritsamudraparyantaprāyah, śīśirapavanabahulah, vañjulavānīropaśobhitatīrābhiḥ saridbhir upagatabhūmibhāgaḥ, kṣitidharanikuñjopaśobhitah, mandapavanānuvījitakṣitīruhagahanah, anekavanarājīpuṣpītanaganaganabhūmibhāgaḥ, snigdhatarupratānopagūḍhaḥ, hamsacakravākabalākānandīmukhapuṇḍarīkakādambamadgubhṛṅgarājaśatapatramattakokilānunādītataruviṭapaḥ, sukumārapuruṣaḥ, pavanakaphaprāyo jñeyah; [...]*

³² See Zimmermann, 1980, pp. 99–106, Zimmermann, 1987, pp. 33–36 and Angermeier, 2016, p. 24.

³³ See Zimmermann, 1987, especially pp. 2–7, 10–19 and 64–95.

The wetlands, now, are to be recognized as

- densely covered by woods of cycadales³⁴, Indian bay leaf³⁵, coconut trees and banana plants,
- bordering, for the most part, on rivers or oceans,
- abounding in cool wind,
- having swaths of land provided with streams having banks adorned with calamus³⁶ and reed³⁷,
- being decorated with mountains and coppices,
- being densely covered with trees fanned by mild winds,
- having swaths of land densely covered with woods full of flowers from many long rows of trees,
- being hidden under lush tendrils of trees,
- having branches which sound with the sounds of swans, ruddy shelducks, intermediate egrets, happyfaces³⁸, pelicans, bar-headed geese, darters³⁹, racket-tailed drongos, peacocks and excited cuckoos,
- being the home of delicate people, and
- being abundant in wind and phlegm.

The description of nature in this environment is the most elaborate one; similar accounts from the other examined works only add details. AS 1.18.28,⁴⁰ for example, additionally mentions luscious soil, green grass, abundance in crops and the frequent occurrence of crawlers and birds. Especially striking in these descriptions are the frequent references to mountains and to forests with great

³⁴This could be *Phoenix paludosa* Roxb. (mangrove date palm), or, as translated above, a kind of *Cycadales* Pers. ex Bercht. & J. Presl, maybe *Cycas circinalis* L. (queen sago) which is native to South India and Sri Lanka.

³⁵This identification is uncertain. According to the PDP, *tamālapattra* is the Indian bay leaf (*Cinnamomum tamala* (Buch.-Ham.) T.Nees & Eberm.). MW identifies *tamālapattra* with *Xanthochymus pictorius* which is a synonym of *Garcinia xanthochymus* Hook. f. ex T.Anderson, a tree related to the mangosteen.

³⁶Uncertain. See Walde & Pokorny, 1973, p. 218.

³⁷According to MW “a sort of cane or reed, Calamus Rotang”.

³⁸This is a literal translation. According to MW, the word denotes a specific water bird.

³⁹According to Dave, 2005, pp. 272–273, *madgu* is the darter (or snakebird), *Anhinga rufa*. However, at least nowadays this bird only lives in Africa. According to MW, *madgu* is a water bird (*Mergus*). Among these fish-eating ducks, the goosander (*Mergus merganser*) is distributed in humid regions.

⁴⁰This lesson is dedicated to the examination of the tastes and explains how different landscapes are seen as sources of different tastes.

plant diversity. The role of the wind remains somehow vague. While the above passage characterizes the wetlands as “abounding in cool wind”, the verses CaS 3.3.47–48 describe this kind of landscape as windless (*nivāta*). SuS, on the other hand, talks about soft and cool wind (*mṛduśītānila*, SuS 1.35.42⁴¹), and Vāgbhaṭa adopts the phrase “cool wind” used in CaS 1.7.8 (*śīśirapavana*, AS 1.18.28). Obviously, the most relevant information here is that wind, if it blows at all, is cool. Strong winds, however, are clearly a feature of the drylands.

In general, *ānūpa* is reckoned an unhealthy surrounding to be avoided. Nevertheless, it does constitute a human living environment and thus is dealt with as such. Its inhabitants usually have “soft, delicate bodies” and are especially vulnerable to diseases caused by the morbidic factors wind and phlegm (see SuS 1.35.42) as well as to elephantiasis, throat diseases, swollen lymph nodes and fever (see AS 1.18.28). The relation between the doctrine of the morbidic factors and the examination of landscapes has been discussed above; however, in the context of the wetlands, we can observe some additional peculiarities. In the passage from the CaS presented above, wind and phlegm are the dominant factors in humid regions. Some passages speak here only of many morbidic or harmful factors, some mention only phlegm, and one names phlegm and bile (!) as dominating factors.⁴² Further characteristics of the wetlands that are relevant to dietetics are sweet taste, difficult digestibility and general unwholesomeness of the local water as well as difficult digestibility of medicinal plants.⁴³

Drylands (*jāṅgala*, *dhanvan* and *maru*)

In contrast to the wetlands, which are always named *ānūpa*, the dry regions are designated by the three terms *jāṅgala*, *dhanvan* and *maru*.⁴⁴ Although these terms may address different facets of dry landscapes in general, at least in the examined medical works they are clearly used as interchangeable synonyms.

⁴¹ This lesson discusses the examination of the patient. In this context, the examination of his dwelling place is also relevant.

⁴² On “many morbidic factors / much harm” see CaS 3.3.47–48 and SuS 1.45.37cd–39ab, on phlegm alone AS 1.1.44, and on “phlegm and bile” AS 1.18.28. In the last passage, an error may have occurred in the transmission of the text since the connection of hot bile with cool wetlands seems rather strange. On the other hand, the commentator Indu also reads *śleṣmapitta*... at this point, without noting any discrepancy. He explains that these two factors affect the constitutions of people and medicinal plants.

⁴³ Concerning taste, see AS 1.18.28, concerning water Indu ad AS 1.6.15, AS 1.18.28 and SuS 1.45.37cd–39ab, and with respect to medicinal plants again AS 1.18.28.

⁴⁴ On the translation of these terms, cf. footnote 11.

The broadest overview on this type of landscape is given again in CaS 7.1.8:

tatrajāṅgalaḥparyākāśabhūyiṣṭhaḥtarubhirapīca,kadarakhadirāsanāśva-karṇadhavatiniśaśallakīsālasomavalkabadarītindukāśvatthavaṭāmala-kīvanagahanah, anekaśamīkakubhaśiṃśapāprāyaḥ, sthiraśuṣkapavanabala-vidhūyamānapranṛtyattaruṇaviṭapaḥ, pratatamṛgaṭṛṣṇīkopagūḍhatanukha-raparūṣasikatāśarkarābahulaḥ, lavatittiricakorānucaritabhūmibhāgaḥ, vā-tapittabahulaḥ, sthirakāṭhinamanuṣyaprāyo jñeyaḥ; [...]

Among these, the drylands are to be recognized as

- being all around abundant in free space but also in trees,
- being densely covered with forests of kadara⁴⁵, cutch trees⁴⁶, Malabar kinos⁴⁷, horse-ear trees⁴⁸, axlewood trees⁴⁹, tiniśa⁵⁰, salai⁵¹, sal trees⁵², somavalka⁵³, jujuba⁵⁴, Malabar ebony⁵⁵, peepal⁵⁶, banyan⁵⁷ and amla⁵⁸ trees,
- being rich in many khejri trees⁵⁹, arjuna⁶⁰ and rosewood trees⁶¹,

⁴⁵Uncertain. The PDP suggests *Acacia polyacantha* Willd. and, as a synonym, *somavalka*. This is unlikely because *somavalka* is mentioned in this list as a separate tree.

⁴⁶*Acacia catechu* (L. f.) Willd., Skt.: *khadira*.

⁴⁷*Pterocarpus marsupium* Roxb., Skt.: *asana*.

⁴⁸Literal translation; Skt.: *aśvakarṇa*. According to the PDP, this is *Terminalia paniculata* Roth or *Shorea robusta* Gaertn., which, however, is usually identified with the subsequently mentioned *sāla*.

⁴⁹*Anogeissus latifolia* (Roxb. ex DC.) Wall. ex Guillem. & Perr., Skt.: *dhava*.

⁵⁰*Desmodium oojeinense* (Roxb.) H. Ohashi, Skt.: *tiniśa*. According to the PDP, this is identical with *syandana*.

⁵¹*Boswellia serrata* Roxb. ex Colebr., Skt.: *śallakī*.

⁵²*Shorea robusta* Roth., Skt.: *sāla*.

⁵³See footnote 45.

⁵⁴Skt.: *badarī*; according to the dictionaries and the PDP *badara* is *Ziziphus mauritiana* Lam., a synonym of *Ziziphus jujuba* Mill. This is questionable because this tree is originally native to China.

⁵⁵*Diospyros malabarica* (Desr.) Kostel., Skt.: *tinduka*.

⁵⁶*Ficus religiosa* L., Skt.: *aśvattha*.

⁵⁷*Ficus benghalensis* L., Skt.: *vaṭa*.

⁵⁸*Phyllanthus emblica* L., Skt.: *āmalaka*.

⁵⁹*Prosopis cineraria* (L.) Druce, Skt.: *śamī*. Meulenbeld suggests further identifications of this tree (cf. SNP p. 602).

⁶⁰*Terminalia arjuna* (Roxb. ex DC.) Wight & Arn., Skt.: *kakubha*.

⁶¹*Dalbergia sissoo* Roxb. ex DC., Skt.: *śiṃśapā*.

- having dancing delicate twigs which are shaken by the force of steady dry winds,
- abounding in fine and coarse hard gravel and sand, hidden behind vast mirages⁶²,
- having swaths of land which are roamed by quails, partridges and chukars,
- abounding in wind and bile and
- being populated by stable and tough people. [...]

Other passages add further details. According to CaS 3.3.47–48, the drylands have little water and trees but stormy winds and abundant heat from the sun. According to SuS 1.35.42, they resemble space⁶³; there are scattered small thorny trees, there is little rain or water, and there are few waterbodies; the wind is warm and rough, and the landscape is structured by detached low hills. AS 1.18.29 draws a similar picture: the drylands are characterized by vast uneven sandy grounds devoid of water and only furnished with sharply incised waters.

The people inhabiting this landscape have stable and lean bodies (SuS 1.35.42) and are able to endure pain. They have a long lifespan and are free from diseases (AS 1.18.29). There are divergent opinions on the influence of this environment on human health. On the one hand, drylands are reckoned as the most wholesome among the three terrestrial environments: diseases are rare and waters are free from harm and wholesome. In contrast to the wetlands, this landscape is suitable for collecting medicinal plants and its animals have the best meat.⁶⁴ On the other hand, some passages deviate from this strict polarization of wholesome drylands and pathogenic wetlands and assign specific diseases and pathogenic factors to both environments. According to SuS

⁶²Literally “deer-thirst”, often translated as *fata morgana*. According to MW, “vapour floating over sands or deserts, fancied appearance of water in deserts”.

⁶³From the context it remains unclear in which ways drylands resemble space (*ākāśa*). The commentator Ḍalhaṇa explains: “Resembling space means having even swaths of land because they (i.e. the drylands), due to the fact that they have no obstacles, are without depressions and elevations” (*ākāśasama iti nirāvaraṇatvān nimnonnatatārahitatvena samabhūmibhāga ity arthaḥ*). The lack of obstacles is a central characteristic of space/ether (*ākāśa*) in Vaiśeṣika philosophy, particularly with regard to the spread of sound. On this topic see Frauwallner, 1956, pp. 30–34.

⁶⁴On wholesomeness see CaS 1.25.40 and AS 1.13.4, on diseases CaS 3.3.47–48, on waters SuS 1.45.37cd–39ab and SuS 1.45.22–23, on medicinal plants CaS 7.1.9 and AS 5.8.2, and on meat AS 1.7.84cd–85.

1.35.42, for example, dry regions promote diseases caused by wind and bile. AS 1.1.44–45ab only mentions wind as the dominating factor in these areas, and in CaS 1.26.88 we learn that rough and pungent food is unwholesome in this surrounding.

Intermediary Regions (*sādhāraṇa*)

In most contexts, wetlands and drylands are complemented by a balanced, temperate landscape. The term *sādhāraṇa*, which is used here, literally means “general” or “common”. This suggests that this region has characteristics of both aforementioned types of landscape. The description in CaS 7.1.8 confirms this hypothesis:

[...] *anayor eva dvayor deśayor vīrudvanaspativānaspatyaśakunimṛgaganayutaḥ sthīrasukumārabalavarṇasamghananopapannasādhāraṇaguṇayuktapuruṣaḥ sādharāṇo jñeyaḥ.*

[... A landscape]

- furnished with plants, trees and flocks of birds and wild animals living in and under trees which pertain to both [aforementioned] landscapes,
 - being the home to people
 - who are stable or very delicate,⁶⁵
 - who are furnished with strength, good complexion and compactness
 - and with intermediary properties
- should be recognized as intermediary.

Further passages simply note that in this case the characteristics known from the two other types are found in a mixed or balanced form. Cold, warmth, rain and wind are temperate and balance prevails among the morbid factors.⁶⁶ These features make the intermediary landscape a favorable living environment in which water is tasty and wholesome and the medicinal plants are suitable for collection.⁶⁷

⁶⁵ Or: “stable and at the same time very delicate”. However, it is unlikely that these slightly contradictory qualities are understood as present together in every single individual. They are rather equally distributed among the inhabitants of this landscape.

⁶⁶ On the climate see SuS 1.35.43, on the morbid factors the very same passage as well as AS 1.1.44–45ab.

⁶⁷ On water see SuS 1.45.37cd–39ab, on medicinal plants CaS 7.1.9 and AS 5.8.2.

Mountains (*śaila*)

Instead of an intermediary zone, which concretely as well as conceptually is located between the cold and humid, and warm and dry territories, some passages introduce a third and independent landscape: the mountains. However, this alternative concept only becomes apparent in discussions on the categorization of waterbodies. In the relevant passages, CaS 1.27.214, AS 1.6.15 and AHS 1.5.13ab, the information about this type of landscape is rather sparse. All three sources merely mention that the quality of water from (local)⁶⁸ waterbodies depends on their localization in one of these zones. According to Zimmermann, this replacement of the intermediary zone is due to the special character of rivers which receive separate treatment in most textual sources but at other times are also named in the list of waterbodies:

At the same time, the rivers are the subject of a geographical classification set out in a distinct sequence. It is at this point that the triad *jāṅgala-ānūpa-śaila* is quite literally mapped: a contrast is established between the rivers flowing westward and those flowing eastward; at their source is the Himalaya range whose streams provide the purest and most beneficent water.⁶⁹

In the following, Zimmermann backs this observation with a quote from CaS 1.27, where in 209–212, in the context of a discussion of the various bodies of water, the rivers are categorized according to their source and direction of flow. It is correct that this categorization is based on geographical regions and orientated according to specific mountain ranges. However, the concept of the aforementioned triad of landscapes is not adopted here. In fact, it is utilized shortly after this passage in order to classify smaller, local waterbodies. One gets the impression that exactly the rivers are less affected by these climatic zones since they may extend through more than just one of them. The classification into wetlands, drylands and mountain waters indeed is valid for smaller bodies of water limited to one zone, such as wells, rivulets, ponds, lakes and so on. Perhaps Zimmermann's view ends up being right and this alternative clas-

⁶⁸ We have to differentiate between smaller, local bodies of water like ponds, lakes, rivulets, etc., and rivers which may not be confined to a single landscape. This distinction is clearly noticeable in the source texts. Among the passages above, CaS 1.27.214 and AHS 1.5.13ab only mention local waterbodies while in AS 1.6.11cd–15ab rivers are definitely included. However, the AS also gives a distinct categorization for rivers in the subsequent passage (1.6.15cd–19c).

⁶⁹ Zimmermann, 1987, p. 69.

sification, which includes mountains instead of an intermediary zone, is really inspired by the observation of rivers without being meant to serve as a tool for their classification.

The examined sources do not give any further details about this additional type of landscape. Moreover, it is impossible to retrieve information from the descriptions of rivers that flow through the mountains because the characteristics mentioned in that context differ from source text to source text and do not apply in general. CaS 1.27.209–212, for example, describes as wholesome the water from rivers that originate from the Himālaya and Malaya mountains, while rivers that spring from the Pāriyātra, Vindhya or Sahya range can cause specific diseases. Suśruta, however, explains as wholesome only those rivers which originate from the Pāriyātra, whereas water from all the other mentioned mountain ranges may cause several ailments (SuS 1.45.21). It is therefore impossible to formulate general characteristics of mountainous regions based on the descriptions of rivers. However, at this point a glance into the commentaries proves helpful. While Cakrapāṇidatta, in his commentary on CaS 1.27.214, merely provides an alleged quote from Hārīta which cannot be found in the Hārītasamhitā and mentions only wetlands and drylands, Indu, in his commentary on AS 1.6.15ab, discusses the topic in more detail:

[...] *ānūpe yathoktalakṣaṇe sthitāḥ kūpādayo guravaḥ. dhanvani jāṅgale deśe sthitā ānūpebhyo laghavo bahūdakasambandhābhāvāt. tebhyo jāṅgalebhyah parvatasthānām kūpādīnām atilaghutvam udakānām atyantābhāvād [...]*

[... Waters] such as reservoirs, etc., that are situated in wetlands which have properties as mentioned⁷⁰ are heavy (for digestion). The ones situated in savannas, i.e. drylands, are light compared to those from the wetlands, since they are not connected with much water. Compared to those in the drylands, for reservoirs, etc., situated in the mountains extreme lightness applies, because here water is very rare.⁷¹

This comment remains slightly cryptic. However, it seems to connect the quality of water to the overall availability of water in a specific climate zone. If the

⁷⁰It is unclear where exactly these properties have been mentioned. Perhaps Indu refers to AS 1.1.44–45ab, where the wetlands are characterized as “rich in phlegm”.

⁷¹Literally: “... completely absent”. I understand this as an exaggeration. Alternatively, the word *udaka* here denotes the element water which in fact can be understood as being completely absent from the rocky surroundings of waterbodies in this landscape.

region is rich in water, or if the element water dominates in the region – seen from the perspective of the doctrine of the five elements –, ⁷² the water of its waterbodies is heavy. If water is sparse in general, the actually available water is light.

Hemādri's commentary on AHS 1.5.13ab points in the same direction:

[...] *jāṅgalaḥ – nirjalā bhūmiḥ, anūpaḥ – sajalā, śailaḥ – parvataḥ. jāṅgalasya samīpāḥ kūpādayo laghūdakāḥ, anūpasya gurūdakāḥ, śailasya laghutarāḥ. uktaṃ hi saṅgrahe “dhanvānūpamahīdhrāṇām sāmīpyād guru-lāghavam” iti. khāraṇādīnā ca – “nadīkūpataḍāgodbhīdvāpyādiṣu viśiṣyata anūpe gauravād ambu śaile dhanvani lāghavāt.” iti.*

[...] The drylands are a terrain without water, the wetlands are a terrain with water, a mountain is a hill. Reservoirs, etc., which are near to drylands have light water, those near to wetlands have heavy water, those near to a mountain have even lighter water. For in the Saṃgraha we are told: “From the vicinity to a savanna, wetlands or a mountain results heaviness or lightness.” ⁷³ And Khāraṇādī ⁷⁴ says: “In the case of rivers, reservoirs, ponds, springs, walled reservoirs and so on, the water is differentiated because of its heaviness in the wetlands and its lightness in a mountain and savanna.”

Aruṇadatta's commentary on the same passage does not provide any further details on the mountains.

Thus, information on the mountain regions remains sparse, not least because the above classification is only relevant for a very minor topic in the vast field of Ayurveda. As Zimmermann notes, it is striking, if not irritating, that in other contexts mountains are mostly mentioned in descriptions of the wetlands. ⁷⁵ Here, however, they constitute a separate landscape which has little in common with this humid region. This may simply be due to the diligent observation of nature: waters springing from the Himālaya or Malaya mountains

⁷² On this issue, see Angermeier, 2016, pp. 172–180.

⁷³ This is a citation from AS 1.06.015ab.

⁷⁴ Khāraṇādī or Kharanāda is the author of the so-called Kharanādasamhitā. His date is uncertain, but he must have written his work before Hariścandra. See Meulenbeld, 1999, pp. 695–696.

⁷⁵ Cf. CaS 7.1.8: the wetlands are decorated with mountains and coppices ([...] *kṣītidharanikuṇjopasobhitaḥ* [...]), SuS 1.35.42: the wetlands have many big mountains and trees ([...] *bahumahāparvatavṛkṣo* [...]), and AS 1.18.28: the wetlands are filled with cool winds, mountains ... ([...] *śiśirapavanadharaṇīdhara-...-avakīrṇaḥ*).

have no similarity to waters in wetlands, but have to be treasured even more highly than those of dry areas. The *Suśrutasaṃhitā*, however, does not use this alternative classification at all and also sticks to the triad of dry, humid and intermediary regions in its discussion of local waterbodies.

6. Conclusion

In ancient Indian medicine, the concept of landscapes is not a well-formed doctrine but a recurring flexible theme which appears differently according to the needs of the context.

As a result of this study, we have discerned the conceptualization of several distinctive sets of landscapes or living environments for which the terminology changes and is adapted to the subject. These concepts can be summarized as follows:

1. Plant habitats (*deśa*) are: wetlands, drylands and the intermediary landscape
2. Animal habitats (*cara*) are: wetlands, water, sky and drylands
3. Human environments (*deśa*) are:
 - a. wetlands, drylands and the intermediary landscape
 - b. humid, moderately humid, moderately dry and dry landscapes (only according to AS 1.18)
4. Climatic zones containing specific bodies of water (*deśa*) are:
 - a. wetlands, drylands and the intermediary landscape (general concept)
 - b. wetlands, drylands and mountains (specific concept for local waterbodies)

Though Zimmermann's explanation of the concept comprising mountains (4.b in the above list) as a means to label different types of river water is slightly fuzzy, he may be right inasmuch as the replacement of the intermediary zone by a mountainous zone may have been inspired by the observation of rivers without the resulting concept serving as a tool for their classification.

Concerning the climatic zones, it is important to stress that the intermediary landscape is not simply replaced by the mountains. In fact, it is totally abandoned and the concept of wetlands – which in other descriptions comprises mountains – gets split up. This development was necessary because water springing from the *Himālaya* or *Malaya* mountains was considered much superior to wetlands water and thought to surpass even that of dry areas.

Table 4: Topographical systems – the third type of landscape called *śaila* and *sādhāraṇa* in context

	bodies of water	general/ humans	medicinal plants	taste	animals/meat
CaS	<i>śaila</i> 1.27.214	<i>sādhāraṇa</i> 3.3.47–48	<i>sādhāraṇa</i> 7.1.8–9	–	–
SuS	<i>sādhāraṇa</i> 1.45.37cd–39ab	<i>sādhāraṇa</i> 1.35.42–45	–	–	–
AS	<i>śaila</i> 1.6.15ab	<i>sādhāraṇa</i> 1.1.44–45ab	<i>sādhāraṇa</i> 5.8.2	<i>sādhāraṇa</i> 1.18.28–29	<i>sādhāraṇa</i> 1.7.83, 1.33.7–39
AHS	<i>śaila</i> 1.5.13	<i>sādhāraṇa</i> 1.1.23–24ab, 2.3.79	<i>sādhāraṇa</i> 5.6.1–4	–	<i>sādhāraṇa</i> 1.6.55ab

Thus, altogether, depending on the topic and the source text, we get the following picture: in most contexts, the intermediary (*sādhāraṇa*) landscape is the third type, but when bodies of water – mostly excluding rivers – are discussed, this landscape is replaced by the mountainous region (*śaila*) in all works examined here, exclusive of the SuS (cf. table 4).

Appendix: On Sanskrit Plant Names

When dealing with the names of plants employed in ancient Indian medicine one encounters certain difficulties.⁷⁶ Identifications of plants are often doubtful, dictionaries propose wrong or outdated translations, and the actual usage of other plants with identical or similar names in modern Ayurveda sets the researcher on the wrong track. In order to offer easy-to-read translations I decided to stick to clear identifications wherever possible. In instances where the situation was ambiguous, I go for the most probable identification and briefly discuss the arguments as well as other possible identifications.

My main sources for the identification of plants and the translation of their Sanskrit names were the following resources:

- Meulenbeld’s “Sanskrit Names of Plants and their Botanical Equivalents” (SNP)⁷⁷, supplemented by his “Additions to Sanskrit Names of Plants and their Botanical Equivalents” (ASNP)
- the “Database on Medicinal Plants” (DMP 1-8)

⁷⁶ On this problem see Wujastyk, 1998, pp. 23–29 and Meulenbeld, 1974, pp. 520–521.

⁷⁷ This index is also available online at sanskrit-lexicon.uni-koeln.de/scans/SNPScan/2014/web/.

- the “Pandanus Database of Plants” (PDP).⁷⁸

My source for the currently valid botanical names were the databases of the-plantlist.org and, as second choice, tropicos.org.

Abbreviations for primary sources and reference works

- AHS Aṣṭāṅgahrdayasaṃhitā: Kuṇṭe, Aṇṇā Moreśwar und Kṛṣṇa Rāmchandra Śāstrī Navre (1935). *The Aṣṭāṅgahrdayasaṃhitā of Vāgbhaṭa, with the Commentaries Sarvāṅgasundarā of Aruṇadatta & Āyurvedarasāyana of Hemādri*. Ed. by Sadāśiva Śāstrī Parāḍakara. 6th ed., Bombay: Nirṇaya Sāgar Press.
- AS Aṣṭāṅgasamgraha: Āṭhvale, Anant Dāmodar (1980). *śrīmad vṛddhavāgbhaṭa-viracitaḥ aṣṭāṅgasamgrahaḥ induvyākhyāsahitaḥ*. Pune: Śrīmad Ātreya Prakāśanam. Reprint: Chaukhamba Surbharati Prakashan, 1997.
- ASNP “Additions to Sanskrit Names of Plants and their Botanical Equivalents” by G. Jan Meulenbeld, in: Das, R. P. (1988). *Das Wissen von der Lebensspanne der Bäume. Surapālas Vṛkṣāyurveda*. Stuttgart: Steiner, pp. 425–465.
- CaS Carakasamhitā: Jādavaji Trikamji (1941). *The Carakasamhitā of Agniveśa, Revised by Charaka and Dṛidhabala. With the Āyurveda-Dīpikā Commentary of Cakrapāṇidatta*. 3rd ed., New Delhi: Munshiram Manoharlal. Used reprint: Varanasi: Chaukhamba Sanskrit Sansthan, 1981.
- DMP 1-8 Database on Medicinal Plants Used in Ayurveda. Vols. 1–8: Sharma, P. C. et al. (2002–2008). *Database on Medicinal Plants Used in Ayurveda* (Vol. 1–8). New Delhi: Central Council for Research in Ayurveda and Siddha.
- I ad AS Indu’s commentary “Śaśilekhā” on AS, in: Āṭhvale, Anant Dāmodar (1980). *śrīmad vṛddhavāgbhaṭaviracitaḥ aṣṭāṅgasamgrahaḥ induvyākhyāsahitaḥ*. Pune: Śrīmad Ātreya Prakāśanam. Reprint: Chaukhamba Surbharati Prakashan, 1997.
- MW Monier-Williams, Monier (1899). *A Sanskrit-English Dictionary, Etymologically and Philologically Arranged, with Special Reference to Cognate Indo-European Languages. New Edition, Greatly Enlarged and Improved, with the Collaboration of E. Leumann, C. Cappeller and Other Scholars*. Oxford: Clarendon Press. Reprint: Delhi: Motilal Banarsidass, 1999.
- PDP Pandanus Database of Plants (iu.ffi.cuni.cz/pandanus/database/): Seminar of Indian Studies, Institute of South and Central Asia, Faculty of Arts, Charles University, Prague, 1998. Last access: July 7th, 2017
- SNP “Sanskrit Names of Plants and their Botanical Equivalents” in: Meulenbeld, G. Jan (1974), pp. 520–611.

⁷⁸ iu.ffi.cuni.cz/pandanus/database/.

- SuS Suśrutasamhitā: Jādavji Trikamji und Rām Nārāyaṇ (1938). *Suśrutasamhitā of Suśruta. With the Nibandhasaṅgraha Commentary of Śrī Dalhanāchārya and the Nyāyachandrikā Pañjikā of Śrī Gayadāsāchārya*. Chaukhamba Ayurvijnan Granthamala 42. Bombay: Nirṇaya Sāgar Press. Reprint: Varanasi: Chaukhamba Surbharati Prakashan, 2003.

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