



Ramsar Information Sheet

Published on 10 July 2017

Brazil

Lund Warming



Designation date	5 June 2017
Site number	2306
Coordinates	19°30'07"S 43°59'41"W
Area	23 865,44 ha

Color codes

Fields back-shaded in light blue relate to data and information required only for RIS updates.

Note that some fields concerning aspects of Part 3, the Ecological Character Description of the RIS (tinted in purple), are not expected to be completed as part of a standard RIS, but are included for completeness so as to provide the requested consistency between the RIS and the format of a 'full' Ecological Character Description, as adopted in Resolution X.15 (2008). If a Contracting Party does have information available that is relevant to these fields (for example from a national format Ecological Character Description) it may, if it wishes to, include information in these additional fields.

1 - Summary

Summary

The entire Lund Warming Ramsar Site is located within the Lagoa Santa Karst EPA and is composed of several Protected Areas (PA) that can be divided into two different categories: State Park (1-Sumidouro and 2- Cerca Grande) and Natural Monument (1-Lapa Vermelha; 2-Vargem de Pedra; 3-Experiência da Jaguará; 4-Santo Antônio; and 5-Várzea da Lapa).

The region is located in central-southern Minas Gerais at the intersection between two biodiversity hotspots, the Cerrado (Brazilian savannah) and Atlantic Forest. In terms of carbonatic karstic landscape, it is one of the most important Brazilian regions and is considered to be extremely important for biodiversity conservation (Drummond et al., 2005). The surface relief evolved as a result of the configuration of the groundwater networks and intense dynamics at the rock-soil interface. The combination of these factors favored the appearance of multiple surface water catchment areas, such as the dolines and uvalas, which are large, lowered plains that are seasonally flooded, (forming a system of temporary lakes). This region also contains canyons, blind valleys and collapsed dolines located along fluviokarst segments. Moreover, hundreds of caves, shelters and highly valuable archaeological and palaeontological sites are found in this region. These sites contain a large number of fossils, artifacts and drawings of the first human settlements as well as fossils of extinct Pleistocene megafauna (Berbert-Born 2002, IBAMA 1997, 1998a, 1998b, 1998c, 2007), which were studied by renowned scientists of the 19th century.

The Lund Warming site is composed of Atlantic Forest and Cerrado biomes, which represent two biodiversity hotspots. There are further deciduous and semideciduous forests and rupestrian vegetation associated with limestone and temporary lakes. Together, these different vegetation formations, karst reliefs and temporary lakes confer a high biodiversity and incredible scenic beauty to this region.

2 - Data & location

2.1 - Formal data

2.1.1 - Name and address of the compiler of this RIS

Compiler 1

Name	José Eugênio Côrtes Figueira
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2.1.2 - Period of collection of data and information used to compile the RIS

From year	2014
To year	2014

2.1.3 - Name of the Ramsar Site

Official name (in English, French or Spanish)	Lund Warming
Unofficial name (optional)	Lagoa Santa Karst Environmental Protection Area

2.2 - Site location

2.2.1 - Defining the Site boundaries

b) Digital map/image
<1 file(s) uploaded>

Former maps	0
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Boundaries description

The boundaries of the Lagoa Santa Karst Environmental Protection Area – EPA (Federal Decree 98.881, 25 January 1990) – partially define the border of the Lund Warming Ramsar Site, which is limited to the east by the Velhas River. The details are described in the annex in the section 6.1.2.6

2.2.2 - General location

a) In which large administrative region does the site lie?	Minas Gerais state
b) What is the nearest town or population centre?	Lagoa Santa

2.2.3 - For wetlands on national boundaries only

- a) Does the wetland extend onto the territory of one or more other countries? Yes No
- b) Is the site adjacent to another designated Ramsar Site on the territory of another Contracting Party? Yes No

2.2.4 - Area of the Site

Official area, in hectares (ha):	23865.44
Area, in hectares (ha) as calculated from GIS boundaries	23865.44

2.2.5 - Biogeography

Biogeographic regions

Regionalisation scheme(s)	Biogeographic region
WWF Terrestrial Ecoregions	Cerrado
Marine Ecoregions of the World (MEOW)	

[Other biogeographic regionalisation scheme](#)

The Cerrado is the second largest Brazilian biome, and it encompasses eight states in Central Brazil. The Cerrado region displays a mosaic of ecosystems, including the 'cerradão,' which is similar to a forest; cerrado with low and sparse trees; 'campo cerrado' (dominated by shrubs with scattered trees and a grass understory); 'campo sujo' (savannah vegetation with sparse shrubs) and 'campo limpo' (pure grassland). These ecosystems occur along a gradient with a progressive decrease in tree cover and increase in the grass matrix. In addition, gallery forests are found along the river courses throughout the entire Cerrado region, whereas deciduous forests may be found associated with limestone massifs. The predominant climate in the Cerrado is a seasonal tropical climate with a dry winter. The average annual temperature is 25°C, with a maximum of up to 40°C and a minimum of 10°C. The average annual precipitation is between 1,200 and 1,800 mm, with the months from October to March experiencing the most rain. The relief of the Cerrado domain is usually quite flat. Approximately 50% of its area is located at attitudes between 300 and 600m above sea level, and only 5.5% of the domain is above 900m.

3 - Why is the Site important?

3.1 - Ramsar Criteria and their justification

- Criterion 1: Representative, rare or unique natural or near-natural wetland types

One of the main peculiarities of the Lund Warming Ramsar Site compared to other karst areas worldwide is the large number of temporary lakes (Auler & Piló 2015). There are approximately 40 temporary lakes, formed in karst depressions (dolines, uvalas and poljés), distributed throughout the entire area and are mostly concentrated on the karst plains. Most of these lakes have temporary characteristics, with annual or multiannual cycles conditioned by the rainfall regime associated with the water table level and flow systems of the karst aquifer (IBAMA 1998d). Warming (1908) described the flood and drought cycles of the Sumidouro Lake, and this phenomenon still occurs throughout this entire region, attracting dozens of aquatic bird species (IBAMA, 1997, Rodrigues & Michelin, 2003, Dornas, 2004, Dornas & Figueira, 2012, Figueira et al. in press).

Hydrological services provided

The dolines, sinks and caves, allied to diffuse soil infiltration, feed the underground drainage system, charging the karst aquifer that is the main sources of freshwater for the resident population of the region. The high water quality of their contribution to the Velhas River Basin enables them to positively contribute to the dilution of the large volume of sewage and other effluents released into the Velhas River upstream from the area, which mainly originate from the Belo Horizonte Metropolitan Region (IBAMA 1998d). In addition, grasses cultivation in the moist, fertile clay soils of dolines are used for dairy cattle. The área of the karst of Lagoa Santa represent 4.9% of the Velhas River basin and is considered of extreme importance for its conservation (Plano Diretor do Comitê de Recursos Hídricos da Bacia Hidrográfica do Rio das Velhas 2015). On the other hand, Velhas River is a sub-basin of the longest river that runs entirely in Brazilian territory, the São Francisco (also the fourth longest river in South America), known as "The National Integration River". (Figueira, JEC, Nóbrega, PFA, Dornas T, Aguiar, JB and Drumond, MA. The waterbirds and dynamics of karst temporary lakes. Lagoa Santa Karst (Augusto Auler editor). Springer Verlag, in press).

Other ecosystem services provided

The Cerrado is the second largest Brazilian biome and originally occupied 2,045,064 km², representing the most extensive savannah region in South America. It has a huge biodiversity, in which a large number of endemic species and a high degree of degradation occur (only 20% of the original vegetation cover remained in 2000, with 6.2% of it located in Protected Areas). This biodiversity resulted in this biome's classification as the sixth most important hotspot among the 34 internationally recognised biodiversity hotspots (Myers et al., 2000, Mittermeier et al., 2005). The karst areas of South America correspond to 2% of the world's surface (http://web.env.auckland.ac.nz/our_research/karst/). Between 5 and 7% of Brazil's territory is composed of karst terrain, of which 3 to 5% is found in Minas Gerais, between 17,600 and 29,419 km² (Travassos & Kohler 2009). The Lund Warming site is composed of Atlantic Forest and Cerrado biomes, which represent two biodiversity hotspots. There are further deciduous and semideciduous forests and rupestrian vegetation associated with limestone and temporary lakes. Together, these different vegetation formations, karst reliefs and temporary lakes confer a high biodiversity and incredible scenic beauty to this region. One characteristic of karst environments is the large amount of speleological sites. A total of 26 animal taxa and approximately 559 caves have been recorded in the Lagoa Santa Karst EPA (IBAMA 1998c).

- Criterion 2 : Rare species and threatened ecological communities

- Criterion 3 : Biological diversity

Justification

The different phases of the lake cycle (filling, full, drying and dry) create specific environmental conditions that have different plant formations and food resources associated with them. Because the size of a lake determines its duration, these same variables vary with size as well. Consequently, different phases of the cycle, or different sizes of lakes, attract different species of aquatic and terrestrial birds that find refuge, food and/or nesting sites, or are simply using as stopover place during migration. When the lakes are full, they attract gallinules, wood storks, cormorants, snail kites, ducks, sandpipers, stilts, jacanas, ibis, spoonbills, and kingfishers, among others. Several of these birds are migratory and probably migrate to other wetland areas of Minas Gerais, or even other Brazilian states, where there are seasonal concentrations of waterbirds, such as Rio Paraná valley (Paraná) and the Pantanal (Mato Grosso do Sul and Mato Grosso). The largest karst lakes have large littoral and limnetic zones, and can reach several meters in depth. Their beds and banks can possess a mixture of terrestrial and aquatic vegetation, resulting from the retraction and advancement of the water. Larger lakes also possess a great range of food resources, including fruits, fish, frogs, molluscs, other benthic invertebrates and the macrophytes themselves, with their leaves, seeds and stalks, as well as the terrestrial and aquatic invertebrates that feed and shelter on them. When different lakes are compared at the same time, the larger will have the greater richness of species and larger populations of waterbirds. The lakes also receive migratory birds fleeing the winter of the Northern Hemisphere, such as the Osprey and the Greater-yellow Legs, which winter in South America, and errant migrants which are sporadically observed, such as the Gull-billed Tern, and the Semipalmated Plover. As drought progresses, smaller lakes dry faster and are soon abandoned by birds who concentrate in those that still have water, and are usually more perennial. Drying lakes can be great for foraging by birds such as the Wood Stork and the Roseate Spoonbill. Among the margins, birds that feed on insects, snakes, tadpoles, frogs etc., such as the Buff-necked Ibis, Whistling Herons and Cattle Egrets, can be found (but they are also present during the flood). Terrestrial birds, such as Picauro Pigeons probably seek seeds in the newly exposed lakebed, while Caracaras and Turkey and Black Vultures seek carcasses of frog, waterbirds and fish (Figueira et al. in press).

Criterion 4 : Support during critical life cycle stage or in adverse conditions

3.2 - Plant species whose presence relates to the international importance of the site

Karst depressions (dolines, uvalas and poljés) and their aquatic, higrophilous and terrestrial plants. The lakes of APA Carste differ significantly in aquatic macrophyte species composition and coverage. They can possess floating macrophytes, such as *Salvinia*, *Pistia* and *Eichhornia*, as well as macrophytes rooted in the bottom with emergent leaves, such as *Nymphaea* and *Nymphaoides*, and rooted emergents, some with dense coverage, such as *Typha* and *Juncus*. They can also have plants associated with wet, soggy soils, such as *Ludwigia* and *Cyperus* (IBAMA/CPRM 1998a). As the water level drops, newly exposed soils are gradually covered by terrestrial herbaceous vegetation that advances like a "green wave." Legumes and other shrubby plants intolerant of soggy soils may form very distinct bands in the higher, and drier, areas. Some of these species probably originate from seeds deposited in the soil during the previous dry season when their progenitors reproduced, suggesting that they are plants with a therophyte life cycle. Therophytes are common, for example, in the floodplains of the Pantanal in Mato Grosso. Thus, karstic depressions become large fields, gradually dominated by species with different degrees of affinity for moisture, but are intolerant to soggy soils, and which grow rapidly and enter the reproductive phase quickly. Some months later, in years of intense and regular rainfall, these fields flood and the terrestrial herbaceous vegetation gradually disappears and the process of ecological succession is interrupted, while the aquatic vegetation returns to dominate. During the phase transitions (from dry to flooding and back to dry), space is partitioned between aquatic and semiaquatic plants and terrestrial plants. Shrub plants that do not tolerate excessive moisture languish, but their dry branches can serve as perches and nesting sites for birds. The persistence of the lakes, in continuous ecological succession from aquatic to terrestrial and back to aquatic ecological communities, is threatened by the growing use of underground water associated to urban and industrial expansion, limestone mining and deforestation, that lower the upper level of the karst aquifers (Figueira et al. in press).

3.3 - Animal species whose presence relates to the international importance of the site

Phylum	Scientific name	Common name	Species qualifies under criterion			Species contributes under criterion				Pop. Size	Period of pop. Est.	% occurrence 1)	IUCN Red List	CITES Appendix I	CMS Appendix I	Other Status	Justification
			2	4	6	9	3	5	7								
Birds																	
CHORDATA/AVES	<i>Calidris melanotos</i> 	Pectoral Sandpiper	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				LC 	<input type="checkbox"/>	<input type="checkbox"/>		Migratory bird that uses the area for resting and feeding
CHORDATA/AVES	<i>Charadrius semipalmatus</i> 	Semipalmated Plover	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				LC 	<input type="checkbox"/>	<input type="checkbox"/>		
CHORDATA/AVES	<i>Gelochelidon nilotica</i> 		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				LC 	<input type="checkbox"/>	<input type="checkbox"/>		
CHORDATA/AVES	<i>Jabiru mycteria</i> 	Jabiru	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				LC 	<input checked="" type="checkbox"/>	<input type="checkbox"/>		
CHORDATA/AVES	<i>Tringa flavipes</i> 	Lesser Yellowlegs	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				LC 	<input type="checkbox"/>	<input type="checkbox"/>		Migratory bird that uses the area for resting and feeding
CHORDATA/AVES	<i>Tringa melanoleuca</i> 	Greater Yellowlegs	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				LC 	<input type="checkbox"/>	<input type="checkbox"/>		Migratory bird that uses the area for resting and feeding
CHORDATA/AVES	<i>Tringa solitaria</i> 	Solitary Sandpiper	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				LC 	<input type="checkbox"/>	<input type="checkbox"/>		Migratory bird that uses the area for resting and feeding
Fish, Mollusc and Crustacea																	
CHORDATA/ACTINOPTERYGII	<i>Astyanax rivularis</i> 		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>					<input type="checkbox"/>	<input type="checkbox"/>		
CHORDATA/ACTINOPTERYGII	<i>Rhamdia quelen</i> 		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>					<input type="checkbox"/>	<input type="checkbox"/>		
Others																	
CHORDATA/MAMMALIA	<i>Alouatta guariba guariba</i> 		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>					<input type="checkbox"/>	<input type="checkbox"/>	VU in Brazil	
CHORDATA/MAMMALIA	<i>Callicephus personatus</i> 	Atlantic Titi; Masked Titi	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				VU 	<input type="checkbox"/>	<input type="checkbox"/>	VU in Brazil	
CHORDATA/MAMMALIA	<i>Puma concolor</i> 		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>					<input type="checkbox"/>	<input type="checkbox"/>	VU in Brazil	

1) Percentage of the total biogeographic population at the site

3.4 - Ecological communities whose presence relates to the international importance of the site

Name of ecological community	Community qualifies under Criterion 2?	Description	Justification
Karst depressions (dolines, uvalas and poljes) and their aquatic, hygrophilous and terrestrial plants.	<input checked="" type="checkbox"/>	The vegetation of the Karst depressions furnish food, feeding places, shelter, perches (for nesting or feeding) for aquatic and terrestrial birds.	Different bird species benefit from different phases of the karst lakes with their mosaic of aquatic and terrestrial vegetation.

4 - What is the Site like? (Ecological character description)

4.1 - Ecological character

The 523 caves found in the Lund Warming Ramsar Site and its surroundings serve as refuges for cave fauna. Species of troglonenes, trogloniles and troglonites are found in these caves (ICMbio 2012). Iniesta et al. (2012) surveyed seven caves located in the Sumidouro State Park and found 203 invertebrate and vertebrate species belonging to at least 98 families. Two invertebrate species identified in this survey have troglonite characteristics: *Trichorhina* sp. (Isopoda: Plathyartridae) and the mite *Labidostomatidae* (Acariforme). This latter species demands special attention because of its restricted distribution and extremely small population inside the cave. In addition, a troglonite spider (*Nesticus* sp.) and a troglonite isopod (*Pectenoniscus* sp.) were found in other caves in this region (Trajano & Bichuette 2009).

Although no troglonite fish species have been found in this region (L.R. Ferreira, com. pess.), the archaeologist Anibal Mattos (1961) has described what appear to be troglonite fish in the site called 'vargem do Mucambo' (probably Mocambeiro). Conversely, the fish *Astyanax rivularis* (Order Characiformes, Family Characidae) and *Rhamdia quelen* (Order Siluriformes, Family Heptapteridae) were found in surface running water and groundwater close to the Lapinha Cave (Mariana Araújo Moreira, personal communication), which suggests that these species are trogloniles.

The Lund Warming site is composed of Atlantic Forest and Cerrado biomes, which represent two biodiversity hotspots. There are further deciduous and semideciduous forests and rupestrian vegetation associated with limestone and temporary lakes. Together, these different vegetation formations, karst reliefs and temporary lakes confer a high biodiversity and incredible scenic beauty to this region.

4.2 - What wetland type(s) are in the site?

Inland wetlands

Wetland types (code and name)	Local name	Ranking of extent (1: greatest - 4: least)	Area (ha) of wetland type	Justification of Criterion 1
Fresh water > Flowing water >> M: Permanent rivers/ streams/ creeks		2		
Fresh water > Lakes and pools >> O: Permanent freshwater lakes		4	8	
Fresh water > Lakes and pools >> P: Seasonal/ intermittent freshwater lakes		1	8	
Fresh water > Lakes and pools >> Tp: Permanent freshwater marshes/ pools		3	8	
Fresh, saline, brackish or alkaline water > Subterranean >> Zk(b): Karst and other subterranean hydrological systems		4		Rare

4.3 - Biological components

4.3.1 - Plant species

Other noteworthy plant species

Scientific name	Common name	Position in range / endemism / other
<i>Caryocar brasiliense</i>		
<i>Tabebuia aurea</i>		

4.3.2 - Animal species

Other noteworthy animal species

Phylum	Scientific name	Common name	Pop. size	Period of pop. est.	% occurrence	Position in range / endemism / other
CHORDATA/AVES	<i>Ciconia maguari</i>	Maguari Stork				
CHORDATA/MAMMALIA	<i>Kunsia fronto</i>	Rato-do mato				New species, found in caves
CHORDATA/MAMMALIA	<i>Leopardus pardalis mitis</i>	Gato-maracajá-				
CHORDATA/AVES	<i>Mycteria americana</i>	Wood Stork				
CHORDATA/MAMMALIA	<i>Phyllomys brasiliensis</i>	Orange-brown Atlantic Tree-rat				
CHORDATA/AVES	<i>Platalea ajaja</i>	Roseate Spoonbill				

4.4 - Physical components

4.4.1 - Climate

Climatic region	Subregion
A: Tropical humid climate	Aw: Tropical savanna (Winter dry season)

4.4.2 - Geomorphic setting

a) Minimum elevation above sea level (in metres)

a) Maximum elevation above sea level (in metres)

- Entire river basin
- Upper part of river basin
- Middle part of river basin
- Lower part of river basin
- More than one river basin
- Not in river basin
- Coastal

Please name the river basin or basins. If the site lies in a sub-basin, please also name the larger river basin. For a coastal/marine site, please name the sea or ocean.

São Francisco River Basin and Velhas River sub-basin

4.4.3 - Soil

- Mneral
- Organic
- No available information

Are soil types subject to change as a result of changing hydrological conditions (e.g., increased salinity or acidification)? Yes No

Please provide further information on the soil (optional)

The following soil class units are found in the area: Red Oxisols, Inceptisols, Red Ultisols and Haplic Gleysols. Moreover, rocky outcrops are also found in the area and are composed mostly of limestone rocks distributed throughout the Pedro Leopoldo and Fidalgo districts and in the central portion of Matozinhos (Oliveira et al., 1992).

4.4.4 - Water regime

Water permanence

Presence?
Usually permanent water present
Usually seasonal, ephemeral or intermittent water present

Source of water that maintains character of the site

Presence?	Predominant water source
Water inputs from surface water	<input checked="" type="checkbox"/>

Water destination

Presence?
Feeds groundwater

Stability of water regime

Presence?
Water levels fluctuating (including tidal)

Please add any comments on the water regime and its determinants (if relevant). Use this box to explain sites with complex hydrology.

The high water quality of these streams enables them to positively contribute to the dilution of the large volume of sewage and other effluents released into the Velhas River upstream from the area, which mainly originate from the Belo Horizonte Metropolitan Region (IBAMA 1998d). There are approximately 40 temporary lakes in the Lagoa Santa Karst EPA that are distributed throughout the entire area and are mostly concentrated on the karst plains. Most of these lakes have temporary characteristics, with annual or multiannual cycles conditioned by the rainfall regime associated with the water table level and flow systems of the karst aquifer (IBAMA 1998d).

4.4.5 - Sediment regime

- Significant erosion of sediments occurs on the site
- Significant accretion or deposition of sediments occurs on the site
- Significant transportation of sediments occurs on or through the site
- Sediment regime is highly variable, either seasonally or inter-annually
- Sediment regime unknown

4.4.6 - Water pH

- Acid (pH<5.5)
- Circumneutral (pH: 5.5-7.4)
- Alkaline (pH>7.4)
- Unknown

4.4.7 - Water salinity

- Fresh (<0.5 g/l)
- Mxohaline (brackish)/Mxosaline (0.5-30 g/l)
- Euhaline/Eusaline (30-40 g/l)
- Hyperhaline/Hypersaline (>40 g/l)
- Unknown

4.4.8 - Dissolved or suspended nutrients in water

- Eutrophic
- Mesotrophic
- Oligotrophic
- Dystrophic
- Unknown

4.4.9 - Features of the surrounding area which may affect the Site

Please describe whether, and if so how, the landscape and ecological characteristics in the area surrounding the Ramsar Site differ from the i) broadly similar ii) significantly different site itself:

- Surrounding area has greater urbanisation or development
- Surrounding area has higher human population density
- Surrounding area has more intensive agricultural use
- Surrounding area has significantly different land cover or habitat types

Please describe other ways in which the surrounding area is different:

The surroundings of the Peter Lund Karst Ramsar Site are occupied by large private rural properties, cement industries and cities. Large rural properties, especially of the agricultural sector, limestone mining, an industrial airport that serves high-technology corporations (e.g., biotechnology, electronics) and intense and disorderly urbanization are the main causes of environmental impacts. Although they do not occur directly in the lakes, the presence of mining activities leads to the loss of native vegetation and changes in the quality of the surface water and groundwater (Neri, 2007).

4.5 - Ecosystem services

4.5.1 - Ecosystem services/benefits

Provisioning Services

Ecosystem service	Examples	Importance/Extent/Significance
Fresh water	Water for irrigated agriculture	Medium
Fresh water	Water for industry	Medium

Regulating Services

Ecosystem service	Examples	Importance/Extent/Significance
Pollution control and detoxification	Water purification/waste treatment or dilution	High

Cultural Services

Ecosystem service	Examples	Importance/Extent/Significance
Recreation and tourism	Nature observation and nature-based tourism	High

Supporting Services

Ecosystem service	Examples	Importance/Extent/Significance
Biodiversity	Supports a variety of all life forms including plants, animals and microorganisms, the genes they contain, and the ecosystems of which they form a part	High

Outside the site:

Have studies or assessments been made of the economic valuation of ecosystem services provided by this Ramsar Site? Yes No Unknown

4.5.2 - Social and cultural values

- i) the site provides a model of wetland wise use, demonstrating the application of traditional knowledge and methods of management and use that maintain the ecological character of the wetland
- ii) the site has exceptional cultural traditions or records of former civilizations that have influenced the ecological character of the wetland

Description if applicable

The Lagoa Santa karst site is considered the birthplace of Brazilian palaeontology, archaeology and spelaeology. The high number of caves and shelters in this region harbor numerous Pleistocene fossils and traces of prehistoric human settlements, including rock drawings, tools and human bones.

Peter Lund explored over 800 caves during the period in which he lived in this region, where he found traces of human presence alongside traces of Pleistocene megafauna. In the early 1970s, a French-Brazilian archaeological expedition led by Annette Laming-Emperaire found a fossilised female human skull dated circa 11,000-11,500 years old in the Lapa Vermelha, Pedro Leopoldo municipality. This skull, which was named 'Luzia', is considered the oldest human trace in the Americas (Prous et al., 1998, Figure 6).

The rock art in the Lagoa Santa karst region (known as the Planalto Tradition) was likely made 8,000 ago. Datings in the Lapa Vermelha archaeological site have established a minimum age of 3,800 years.

The first scientific study on the Brazilian Cerrado was published in 1892. This study is the Lagoa Santa Et Bidrag til den biologiske Plantegeografi (translated as Lagoa Santa, A Contribution to Phytobiological Geography) and was authored by Eugenius Warming, a professor of botany at the University of Copenhagen (Figure 3).

Old colonial farms are also a cultural attraction in this region. An example of such farms is the Jaguará Velha Farm, which contains the ruins of the Church of Nossa Senhora da Conceição, built in 1786 (Instituto Terrazul, 2007).

Because of its historical, cultural and biological importance, the region was transformed into a Protected Area in 1990 named Lagoa Santa Karst EPA (IBAMA 1998b). This region was also categorized as a region of importance ranging from 'special' to 'extreme' for biodiversity conservation in Minas Gerais (Drummond et al., 2005).

iii) the ecological character of the wetland depends on its interaction
with local communities or indigenous peoples

iv) relevant non-material values such as sacred sites are present and
their existence is strongly linked with the maintenance of the ecological
character of the wetland

4.6 - Ecological processes

<no data available>

5 - How is the Site managed? (Conservation and management)

5.1 - Land tenure and responsibilities (Managers)

5.1.1 - Land tenure/ownership

Public ownership

Category	Within the Ramsar Site	In the surrounding area
National/Federal government	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

Private ownership

Category	Within the Ramsar Site	In the surrounding area
Other types of private/individual owner(s)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

Provide further information on the land tenure / ownership regime (optional):

a) within the Ramsar site:

The land is private in the largest part of the Peter Lund Karst site. The state owns 50% of the area of Sumidouro State Park, which has an area of 2,000 ha. Other Protected Areas located on private land in the region are currently in the process of expropriation by the state.

c) in the surrounding area:

The surroundings of the Peter Lund Karst Ramsar Site are occupied by large private rural properties, cement industries and cities.

5.1.2 - Management authority

Please list the local office / offices of any agency or organization responsible for managing the site:

Coordenação Regional 11 - Lagoa Santa: Instituto Chico Mendes de Conservação da Biodiversidade - ICMBio :
Alameda Dra. Vilma Edelweiss dos Santos, 115 – Bairro Lundcécia – Lagoa Santa/Minas Gerais

Instituto Chico Mendes de Conservação da Biodiversidade - ICMBio (head office):
EQSW 103/104, Bloco “C”, Complexo Administrativo - Setor Sudoeste CEP: 70.670-350 - Brasília - DF

Provide the name and title of the person or people with responsibility for the wetland:

Mr. Ricardo de Magalhães Barbalho, Head of Lagoa Santa Karst EPA

Postal address:

Alameda Dra. Vilma Edelweiss dos Santos, 115 – Bairro Lundcécia. Lagoa Santa/MG, Brazil, postcode: 33.400-000

E-mail address:

ricardo.barbalho@icmbio.gov.br

5.2 - Ecological character threats and responses (Management)

5.2.1 - Factors (actual or likely) adversely affecting the Site's ecological character

Human settlements (non agricultural)

Factors adversely affecting site	Actual threat	Potential threat	Within the site	In the surrounding area
Housing and urban areas	unknown impact	unknown impact	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Commercial and industrial areas	unknown impact	unknown impact	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Water regulation

Factors adversely affecting site	Actual threat	Potential threat	Within the site	In the surrounding area
Drainage	unknown impact	unknown impact	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Water abstraction	unknown impact	unknown impact	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

Agriculture and aquaculture

Factors adversely affecting site	Actual threat	Potential threat	Within the site	In the surrounding area
Annual and perennial non-timber crops	unknown impact	unknown impact	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Energy production and mining

Factors adversely affecting site	Actual threat	Potential threat	Within the site	In the surrounding area
Mining and quarrying	unknown impact	unknown impact	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Transportation and service corridors

Factors adversely affecting site	Actual threat	Potential threat	Within the site	In the surrounding area
Roads and railroads	unknown impact	unknown impact	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

Natural system modifications

Factors adversely affecting site	Actual threat	Potential threat	Within the site	In the surrounding area
Vegetation clearance/ land conversion	High impact		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

Please describe any other threats (optional):

a) within the Ramsar site:

Many threats to the temporary lake system and other landscape units of the Peter Lund Karst region have been identified. The native vegetation has been largely modified through conversion into pastures and agricultural fields, construction of roads and the urbanisation process. The conversion of the region's forests and cerrados into farms and pastures dates back to the 19th century (IBAMA, 1998b). The impoverishment of the native fauna and overload of the karst aquifer are expected problems. In addition, certain doline sinkholes have been intentionally blocked, precluding water drainage and making these lakes more permanent. The construction of roads in this region has seriously impacted many of the temporary lakes because some of the roads were built on the margins or beds of these lakes. The ill-planned placement of cemeteries and landfills, in addition to the construction of dwellings and hotels, also directly threatens the lake system (Hardt, 2008; Milanovic, 2002; Urich, 2002), because the sinkholes of some of the temporary lakes are water absorption sites that supply a whole groundwater drainage system (Hardt, 2008; Sampaio, 2010). However, there are also Protected Areas within the borders of the Peter Lund Karst Ramsar Site, such as the Sumidouro and Cerca Grande State Parks and Lapa Vermelha, Vargem de Pedra, Experiência de Jaguará, Santo Antônio and Várzea de Pedra Natural Monuments, which may influence decisions aimed at reducing the impacts to this region.

b) in the surrounding area:

Large rural properties, especially of the agricultural sector, limestone mining, an industrial airport that serves high-technology corporations (e.g., biotechnology, electronics) and intense and disorderly urbanisation are the main causes of environmental impacts. Although they do not occur directly in the lakes, the presence of mining activities leads to the loss of native vegetation and changes in the quality of the surface water and groundwater (Neri, 2007).

5.2.2 - Legal conservation status

National legal designations

Designation type	Name of area	Online information url	Overlap with Ramsar Site
national protected area	Lagoa Santa Karst Environmental Protection Area		partly
natural monuments	Lapa Vermelha, Vargem de Pedra, Experiência da Jaguará, Santo Antônio and Várzea da Lapa		partly
state protected area	Cerca Grande state park		partly
state protected area	Sumidouro state park		whole

5.2.3 - IUCN protected areas categories (2008)

- Ia Strict Nature Reserve
- Ib Wilderness Area: protected area managed mainly for wilderness protection
- II National Park: protected area managed mainly for ecosystem protection and recreation
- III Natural Monument: protected area managed mainly for conservation of specific natural features
- IV Habitat/Species Management Area: protected area managed mainly for conservation through management intervention
- V Protected Landscape/Seascape: protected area managed mainly for landscape/seascape conservation and recreation
- VI Managed Resource Protected Area: protected area managed mainly for the sustainable use of natural ecosystems

5.2.4 - Key conservation measures

Legal protection

Measures	Status
Legal protection	Implemented

Habitat

Measures	Status
Improvement of water quality	Proposed

Human Activities

Measures	Status
Communication, education, and participation and awareness activities	Implemented

Other:

There is a proposal to create a surface water and groundwater monitoring program to identify fragile areas and to limit the anthropogenic activities that may compromise water quality, in the Lund Warming Ramsar Site. There are others proposals, which are listed below.

- Program for the adoption of alternative technologies for agricultural activities within the area to change the fertilization and pesticide application practices in areas where these practices may compromise the quality of the karst waters.
- Program aimed at the implementation of sewage treatment networks designed to deactivate cesspools at sites where they may represent an infiltration danger. This program is advised by the Sanitation Company of Minas Gerais.
- Program to promote tourism in the area by encouraging the participation of local groups and creating an infrastructure to enable the work of the people involved.
- Integrated sanitation program for the entire region with the establishment of sewage systems in urban communities and septic tanks in the rural and peri-urban areas Lapinha, Fidalgo, Quinta do Sumidouro, and Mocambeiro.

The Lagoa Santa Karst Environmental Protection Area has already had a management plan since 1998, presenting specific areas of management, and since 2015 is under negotiation its revision. The municipalities of Lagoa Santa, Pedro Leopoldo and Matozinhos have Executive Plans, and the Sumidouro State Park also has a management plan that can contribute to the protection and conservation of the lagoons in its interior.

5.2.5 - Management planning

Is there a site-specific management plan for the site? No

Has a management effectiveness assessment been undertaken for the site? Yes No

If the site is a formal transboundary site as indicated in section Data and location > Site location, are there shared management planning processes with another Contracting Party? Yes No

Please indicate if a Ramsar centre, other educational or visitor facility, or an educational or visitor programme is associated with the site:

Magazine of the Manuelzão Project, which aims to promote awareness, social mobilization, environmental education and recovery of local cultures as well as to identify the environmental impacts on the Velhas River Basin. This publication is available online (http://www.manuelzao.ufmg.br/publicacoes/revista?revista_start=60).

The Peter Lund Museum will contain approximately 80 human and animal fossils discovered in the region by Lund (<http://www.acervosmuseologicos.org.br/?p=773>). The collection of the Lapinha Archaeological Museum contains human fossils and their artifacts as well as fossils of the regional Pleistocene fauna in its collection (http://www.lagoasantamg.com.br/paginas_site/default.asp?PAG_SEQ=6277).

<http://www.manuelzao.ufmg.br/>

URL of site-related webpage (if relevant): <http://www.icmbio.gov.br/portal/biodiversidade/unidades-de-conservacao/biomas-brasileiros/cerrado/unidades-de-conservacao-cerrado/2057-apa-do-carste-de-lagoa-santa.html?highlight=WyJsYWdvYSIsInNhbnRhl iwibGFnb2Egc2FudGEiXQ==>

5.2.6 - Planning for restoration

Is there a site-specific restoration plan? Yes, there is a plan

5.2.7 - Monitoring implemented or proposed

Monitoring	Status
Water quality	Proposed

There is a proposal to create a surface water and groundwater monitoring program to identify fragile areas and to limit the anthropogenic activities that may compromise water quality, in the Peter Lund Ramsar Site.

The Manuelzão Project is also underway in the Lagoa Santa Karst EPA. This project was created in 1997 by professors from the School of Medicine of the Federal University of Minas Gerais (Universidade Federal de Minas Gerais - UFMG), and its aim is to advocate for improved environmental conditions to promote the health and quality of life, which is opposed to the predominantly welfare-based system. The Velhas River drainage basin was selected as the group's focus of operation. The partnership with the local community has grown considerably during the project's existence and includes the participation of civil society, government representatives and water users. The project has also been conducting important research activities, including water quality biomonitoring, geoprocessing and riparian forest restoration.

The Sumidouro State Park, which is included in the Peter Lund Karst area, performs on-going surveillance, monitoring and restoration activities in accordance with the management plan.

6 - Additional material

6.1 - Additional reports and documents

6.1.1 - Bibliographical references

The whole list of references is in the section 6.1.2.6

6.1.2 - Additional reports and documents

i. taxonomic lists of plant and animal species occurring in the site (see section 4.3)

<no file available>

ii. a detailed Ecological Character Description (ECD) (in a national format)

<no file available>

iii. a description of the site in a national or regional wetland inventory

<no file available>

iv. relevant Article 3.2 reports

<no file available>

v. site management plan

<no file available>

vi. other published literature

<1 file(s) uploaded>

6.1.3 - Photograph(s) of the Site

Please provide at least one photograph of the site:



A, B, C) Sumidouro Lake in different seasons, D) sinkholes of the Sumidouro Lake, E) Limestone massif of the Cerca Grande State Park and archaeological site, F) Canyon in the Baiú Cave limestone, G) Flooded doline in Cerca Grande, H) Lush forest, I) trunk and roots of a dry forest tree. J) Lapa Vermel (*JEC Figueira and P Nibrega, 01-01-2012*)

6.1.4 - Designation letter and related data

Designation letter

<1 file(s) uploaded>

Date of Designation 2017-06-05